



FISHERIES PROGRAMME
INFORMATION SECTION

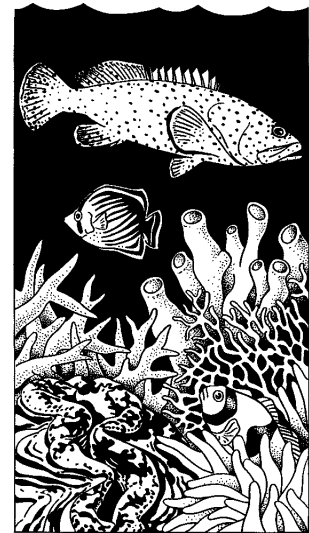
The
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LIVE REEF FISH

The Live Reef Fish Export and Aquarium Trade

Number 1 — March 1996

INFORMATION BULLETIN



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Editorial

Welcome to the new Special Interest Group (SIG) on the live reef-fish (export and aquarium) trade. This SIG will operate as a network of individuals working in, doing research on, or otherwise concerned about the live reef-fish trade, and will encourage the sharing of ideas, experience and information.

Good news for those of you who are in the front line in the war against the excesses of the live reef food fish (or simply 'the') trade. Recent media coverage shows clearly that the world is now taking the fast-spreading environmental damage being done by the trade very seriously. There have been long front-page stories in *The New York Times* and the *International Herald Tribune*, as well as major stories in many other newspapers in the US, Australia and South-East Asia.

CNN television did two long news stories (broadcast to 210 countries!). A two-page feature article came out in the *New Scientist*. Voice of America will very likely have broadcast a story on the subject by the time you read this. *Time Magazine* is carrying out a major investigation of the issue, using several reporters. Much additional media coverage is due in the next few months.

The group coordinators of the SIG are Bob Johannes (for live reef fish—see address above) and Larry Sharron (for reef aquarium fish—Coral Reef Research Foundation, P.O. Box 1713, Koror, Palau 96940, Fax: (680) 488 2305).

Our principal focus is on SPC member countries and territories, but persons with an active interest in these subjects in any part of the world are encouraged to join this special interest group, submit information to the bulletin and receive the bulletin free. Since the live reef food-fish trade in the Pacific is inextricably linked with East Asia, and the marine aquarium trade is also very significant in the latter region, people from East Asia with an active interest in the subject are especially encouraged to participate. (cont'd page 2)

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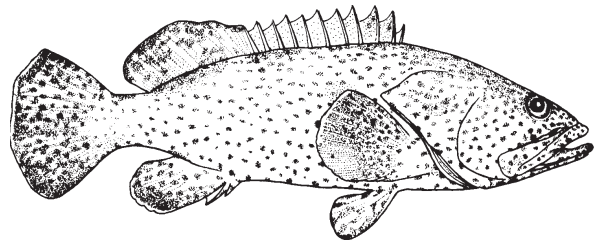
Contributions to the newsletter are sought, including: details of research on relevant subjects; statistics on the trade, including quantities of live fish, exported/imported by various countries; descrip-

tions of efforts to run the trade on an environmentally sustainable basis; management measures; forthcoming conferences, workshops and other events; copies of reports and newspaper articles for inclusion in the annotated bibliography of recent publications and reports, which will be part of each newsletter; reviews of significant reports, documentaries, etc.; questions and requests for information (and responses thereto); contact addresses and other relevant information on people who ought to receive the newsletter; and reports on conferences and workshops.

Thank you in advance.

Bob Johannes

LIVE REEF FISH I N F O



Minutes of the regional workshop on the live reef food-fish trade in Asia and the Western Pacific

*by Rili Djohani,
The Nature Conservancy,
Jakarta, Indonesia*

Introduction

The first workshop on the live reef-fish trade in Asia and the Western Pacific was held in Jakarta on 7 November 1995 in conjunction with the Second Conference of the Parties to the Convention on Biological Diversity (COP2). It was sponsored by the Indonesian State Ministry of Environment and The Nature Conservancy.

Over-fishing of spawning aggregations and the use of sodium cyanide to catch live reef fish have caused serious and widespread damage to the world's richest marine environments. The trade is dominated by Hong Kong fishing companies and supports a rapidly growing restaurant trade in live reef fish.

The aim of the workshop was to bring together individuals from the region who are concerned with this issue. The objectives were:

- ☞ to initiate a dialogue and an action plan between the fishing industry, mariculture ex-

perts, relevant governments and non-government conservation organisations from the region;

- ☞ to produce a framework for action that will guide efforts to move towards a sustainable fishery;

- ☞ to generate a greater awareness of this complex and urgent environmental problem.

Opening remarks from Minister Sarwono

Minister Sarwono emphasised his concern over the devastating effects of the live reef-fish trade on the Indonesian reefs and those of other countries in the region. He stressed the need for action from the Government of Indonesia in addressing the impacts of the live reef-fish trade, particularly from the Department of Agriculture and the Directorate-General of Fisheries.

'The live reef-fish trade is very profitable', he stated, 'and our goal is not to stop the trade, but to ensure

the use of sustainable techniques which will not destroy the reefs and the long-term benefits that they provide to mankind'. He encouraged the workshop to develop a solution-oriented approach to the problems, and innovative ways of thinking that are compatible with conservation and income generation. He said that strengthening the capacity of coastal communities to manage their own marine resources will help us enforce fishing regulations across the archipelago. The Minister also encouraged the use of mariculture of target fish species to replace wild-caught fish.

The workshop was a promising way, he said, to initiate a dialogue among the key countries and industries involved in the live reef food-fish trade. He referred to the impressive exhibition and video on the live reef-fish trade, sponsored jointly by his Ministry and The Nature Conservancy, as effective education tools. The Minister also specifically addressed the Indonesian press. 'There are other workshops at COP2 with more people in attendance,' he said, 'but this is an extremely important issue for Indonesia; please pay close attention to it.'

Bob Johanne's Keynote Address

(A summary of this address can be found on page 18)

Preceding his address, Dr Johannes narrated a seven-minute video which exposed foreign fishermen using sodium cyanide to catch Napoleon wrasse in eastern Indonesia. The video clearly showed the destructive nature of fishing with poisons, both on the corals and smaller, non-target fish and other marine organisms.

Questions from the audience; replies from Bob Johannes

Q. *What is the recovery time of coral reefs?*

A. Variable, but generally several decades for complete recovery of a badly damaged reef—if the reefs are allowed to recover. In reality, however, impoverished fishermen in many places in South-East Asia feel they cannot afford to leave their reefs alone to recover; they need to continue to fish to survive.

Q. *Where are good examples of community-based management projects?*

A. Examples in the Pacific Islands are widespread and are facilitated by government recognition and support of local control over reef resources. Vanuatu and Palau offer some especially good examples. In South-East Asia, the Philippines provides perhaps the best examples. Here local villagers are becoming increasingly involved in the management and enforcement of

coral reef fisheries and setting up and maintaining marine sanctuaries.

Q. *How many companies are importing live reef fish into Hong Kong and how many of these are involved in illegal activities?*

A. Between 100 and 150 companies are importing live fish. We do not know how many of these are involved in illegal trade. There are no cyanide detection labs set up in Hong Kong to check whether fish have been caught with cyanide.

Comment from the Indonesian Tuna Fisheries Association:

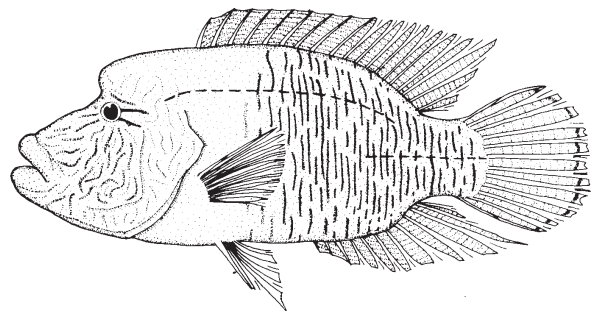
It is difficult to ignore the demand from Hong Kong and Singapore for live food fish. Many of the boats that come here from Hong Kong are not under the control of the Indonesian Directorate General of Fisheries because they enter the Indonesian waters as cargo boats. The regulations of the Directorate-General of Fisheries apply only to boats registered as fishing boats.

The distribution of cyanide must be controlled by the Government of Indonesia. Outside fishermen claim that certain species can only be caught with the use of bombs, for example, red-tail and yellow-tail tuna. There is a need to inform the governments of Singapore and Hong Kong about these destructive fishing methods and develop sustainable techniques.

Fishermen from eastern Indonesia have requested from the Fisheries Association information and expertise on mariculture to supply live reef fish.

Q. *Is the Napoleon wrasse protected by the Government of Indonesia?*

A. A limited export is allowed by a complex system of permits which have to be obtained at the Ministry of Trade and the Directorate General of Fisheries. Certain criteria will be specified under this new regulation, such as location and techniques.



However, this is a difficult regulation to enforce. Napoleon wrasses are still exported on a large scale, falsely labelled as groupers. Regulations alone are not sufficient. An integrated and comprehensive approach is necessary to address the problem.

Q. Is collection of grouper fry allowed for mariculture projects? Is the export of cultivated species such as the Napoleon wrasse and groupers allowed?

A. Minister Sarwono stated that only recognised institutes are allowed to collect fry and juvenile fish, for research purposes. For example, the mariculture research in Lampung collects juvenile groupers to raise in connection with its research on grouper mariculture.

Q. Which industries use cyanide?

A. The mining and electro-plating industries are the primary users. We are not sure who the main sources for cyanide fishing are.

Panel Discussion

Twelve panel members from Taiwan, Papua New Guinea, Palau, Philippines and Indonesia participated in the workshop. They were:

Indonesia

Dr Ir. Surna T. Djajadiningrat, Assistant Minister for Coordination and Implementation of the State Ministry of Environment

Ir. Sumyaryo Sumiskum, Secretary-General, Indonesia Tuna Association

Mr Surya Mulandar, Executive Director, Gugus Analysis, Representative Bio-forum (an NGO)



Taiwan

Dr Lee Ling Ling, Associate Professor, Department of Zoology, National Taiwan University and SWAN (an NGO)

Dr Kwang-Tsao Shao, Research Fellow, Institute of Zoology, Academia Sinica

Papua New Guinea

Mr Mick Raga, Ministry of Conservation and Environment

Philippines

Dr Vaughan Pratt, President, International Marinelife Alliance (IMA)

Mr Marciano F. Carreon III, Assistant Program Director, Fisheries Sector Program, Department of Agriculture

Palau

Executive Director, Palau Conservation Society

The Nature Conservancy

Mr Chuck Cook, Director, TNC Asia-Pacific Coastal and Marine Program

Dr Bob Johannes, TNC Asia-Pacific Program Consultant

Chuck Cook opened the discussion by raising enforcement issues regarding the live reef-fish trade. Mr Mardiono of the Indonesian Navy stated that there is a 'Sea Security Board' in Indonesia. This board consists of representatives from the navy, police, immigration, customs, fisheries and all other agencies involved in coordination of patrols with neighbouring countries such as Singapore, the Philippines and Australia. The protection of the Indonesian territorial waters is the responsibility of the Indonesian Navy.

However, Mr Mardiono mentioned that it is difficult to catch illegal fishing boats, which mainly come from Taiwan, Hong Kong, Thailand and China, because they operate outside the exclusive zone. In addition, it is complicated to arrest non-fishing boats which do not have fishing gear but just holding tanks. In particular, these mother ships play an important role in reviving and transporting live groupers and wrasses to Hong Kong.

Introduction of panellists

Mick Raga explained that local land and coastal marine tenure systems in Papua New Guinea are recognised by the government. Ninety per cent of the land is owned by the people. The live reef-fish trade is a problem because the fishing activities occur at remote reefs in uninhabited areas and extensive poaching is most likely occurring. In addition to cyanide fishing, dynamite fishing is a big problem that is difficult to deal with.

Vaughan Pratt stated that the International Marinelife Alliance in the Philippines was the first group to document cyanide fishing in the 1980s. This NGO works together with the Philippines Government on cyanide reform programmes, including monitoring and training activities. He offered to share their experience and expertise with other countries in the region.

Marciano Carreon is involved in the Fisheries Sector Program in the Philippines Department of Agriculture. He mentioned his involvement in the implementation of community-based management projects and said that he had learned a lot about the conditions of success and failures of such projects. The programme is working towards the completion of a coastal resource management plan for the country, with a goal of decentralising fisheries management.

Surya Mulandar has worked extensively with fishing communities that use cyanide to catch ornamental fish in Pulau Seribu National Park, Indonesia. He expressed his concern about the income fluctuations of those fishing communities and how these lead to destructive fishing practices. He said he wanted to learn from other regional experiences how to ensure a stable income for communities involved in cyanide fishing through alternative techniques and livelihoods.

Noah Idechong has had eight years of experience with fisheries development in Palau, first with the national government and now with an NGO. A major challenge in Palau, he said, is to balance tourism and fishing activities and ensure the associated financial benefits accrue to local people.

Kwang-Tsao Shao has been involved in fish taxonomy as well as mariculture research. He is currently working on a database for fishes of Taiwan.

Sumyaryo Sumiskum said that the improvement of the quality of life for traditional fishermen is an essential issue we all must consider. He mentioned

eastern Indonesia as a priority geographical area which should be the focus of our attention.

Surna Djajadiningrat (Pak Naya) expressed his personal interest in marine conservation. 'The sea is the resource of our future in South-East Asia,' he said.

Comments from panellists follow on the recommendations proposed in: 'The environmental, economic and social implications of the live coral-reef food-fishery in Asia and the Western Pacific' (Johannes & Riepen, 1995).

Recommendation 1:

Convince government regulatory agencies that the live food-fish trade is a distinctive form of fishery requiring special controls.

Pak Naya: The trade is much better organised and financed than the regulatory agencies. It is not a single country problem. We need to address the issue on a regional scale and bring regional pressures and resources to bear.

Vaughan Pratt: In the Philippines, 50 per cent of the live reef-fish trade goes through Manila. Live fish exports in the Philippines need to have 'cyanide clearance' from the Bureau of Fisheries. This is done by random sampling at any time. It would be easier if the exports were funnelled through a single airport or export destination.

Marco Carreon: The Philippines is working on a decentralised, integrated fisheries management plan (funded by the Asian Development Bank) which takes into account the archipelagic nature of the country. Regional task forces have been set up which include NGOs, fish wardens, local police and other stakeholders. They are trying to get away from the vigilante approach. Instead, efforts are underway to standardise enforcement and establish a general framework on coastal zone management which takes into account community-based management experiences. The political will at all levels is essential to make the programme work.

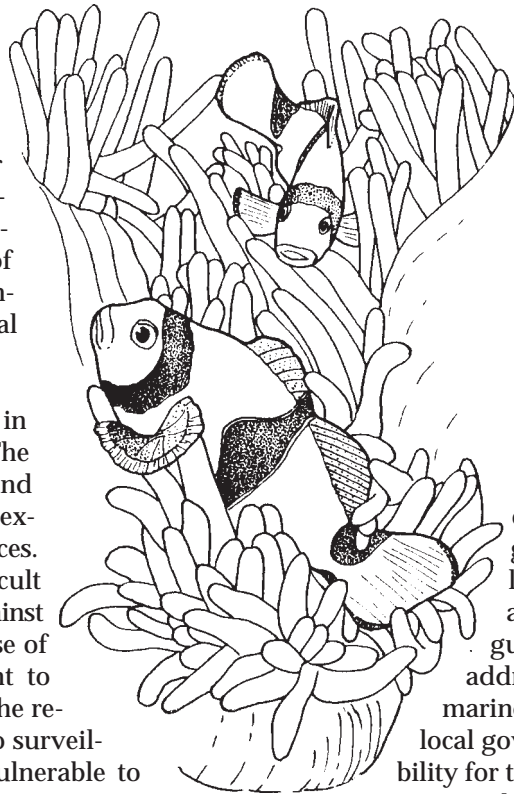
Recommendation 2:

Provide villagers with the incentive to protect their marine resources by giving them the legal right to exclude outsiders from their fishing grounds—or, where that right already exists, provide stronger government backing. Train, deputise and support village fishermen as fish wardens.

Noah Idechong: That's the solution! The Philippines and Palau have taken steps to empower local communities. For example in Palau, the grouper spawning sites are extremely valuable resources to this small island nation. One or two of these sites were previously fished out by a Hong Kong company. At the time, there was no formal legislation in place to regulate this type of overfishing. In 1993, the government formally recognised the rights of local communities to enforce protection of their own reefs, a tradition which has existed for hundreds, if not thousands of years. We have noticed that foreign fishermen employed by live reef-fish companies do not have an incentive to protect the coral reefs. If you want to develop resources for our own people, then give them the right to control or use their own marine resources. This increase of responsibility will increase both the enforcement of the area and as the living standard and benefits to the local people.

Mick Raga: Villages and clans in PNG have their own reefs. The local people formulate rules and regulations regarding their exploitation of the marine resources. However, in practice it is difficult to enforce these regulations against outside encroachment because of lack of boats and equipment to patrol the area sufficiently. The remote isolated islands have no surveillance whatsoever and are vulnerable to poaching. Recently, a poaching Taiwanese boat was grounded, arrested and taken to Port Moresby. It was sold back to Taiwan for US\$3 million.

Suraya Afiff: (Walhi: Indonesian Environmental Forum): In Papua New Guinea, customary rights are acknowledged by the national government, which leads to better local control over resources. To be effective, marine tenure systems need to be recognised by national governments. A recommendation should be added to stimulate governments, particularly the Indonesian Government, to replace the open access system with a system in which exclusive fishing rights are granted to local communities. In addition, monitoring and some enforcement activities should be decentralised to local communities.



Pak Naya: He agreed with Recommendation 2, but the key question is how to improve the quality of life of fishing communities, who are among the poorest societies in South-East Asia. There is a need for innovative approaches to develop stable income-generation projects in these communities. Money-lending institutions such as the World Bank, the Global Environmental Facility and the Asian Development Bank should adopt a direct approach to support local communities; at present, most of the money goes into consultancy firms. The approach is also too sectoral. Linkages should be established between the private sector, government and local people which are supported by direct and integrated funding mechanisms.

Marco Carreon: The Philippines used to have the open access system, but now the responsibility of marine resources (up to 15 km from shore) lies with the municipalities. These waters are primarily for exclusive use of municipal fishermen. However, outside fishermen and commercial fishing companies often encroach. The national government faces a new challenge, i.e., the development of a legal framework, including guidelines and legislation, to address local fishing issues and marine resource use conflicts. The local government is gaining responsibility for the design and enforcement of operational regulations. The problem is that most municipalities do not have the capacity and technical expertise to accomplish this objective. A lot depends on the local political will. In one case, the mayor is shooting at outside fishermen; in another case the mayor is accommodating foreign commercial fishing operations.

Surya Mulandar: The benefits to local fishermen versus live reef food fish companies are comparatively very low; a more equal distribution of benefits in the trade is important to strive for.

Bob Johannes acknowledged this gap but said a number of companies went broke because of high mortality of fish. Some companies make big profits, but others lose money. The profit margins may not be as high as they appear. Companies should be taught to handle their fish properly during catching, holding and transport.

Sumyaryo Sumiskum: Indonesia's coastline is 81,000 km long. Recommendation 2 will be endorsed at the international and national level, but the perceptions at the provincial level can be very different. Other interests may prevail. Successful implementation of Recommendation 2 depends on the ability, experience and the presence of traditional management systems in the province. Therefore, it cannot be made a blanket recommendation. It needs to be refined at the provincial level with the involvement of provincial authorities and fishing communities.

Bob Johannes: In support of Sumyaryo Sumikum, he said that the COREMAP (Coral Reef Rehabilitation and Management Project) perspective is that the introduction of local control is good, but a standardised blanket approach will fail. Target areas with a likelihood for success need to be selected first, where, for example, traditional systems are still working (Sasi systems in the Moluccas, Indonesia, for example). If successful, this will help encourage the introduction of similar systems elsewhere. Village leaders ought to be taken to visit villages where successful local marine resource management is operating.

Andy (Indonesian NGO): The role of the local government needs to be emphasised. The Sasi (traditional resource ownership) system is recognised by the national government, but it is the responsibility of the local government to make legal provisions at the provincial level.

Pak Naya: The basic problem is poverty, and therefore economic empowerment of local communities is essential.

Representative from Fiji: Fiji has a similar system to that of the Philippines, i.e. the right of villagers to control the use of their marine resources. (The ownership of resources by indigenous people is not recognised by the Government—as is the case in most countries). There is a two-tier system for licensing fishing activities. The activity must be approved by: 1) indigenous fishermen, and 2) the Department of Fisheries.

Questions from the audience:

- 1) *What methods are available to make the live reef fish trade a sustainable fishery?*
- 2) *What is the actual capacity of the cyanide detection lab? What is the equipment and expertise required?*

Vaughan Pratt: The cyanide test is based on ion-selective electrodes; cyanide levels as low as 0.001

ppm can be detected. The test is very sensitive and accurate; there are no false positives. The standardised procedure is random. On a routine basis, 60 to 70 tests are carried out per day in a lab. It requires good quality control which is quite time-consuming. Tissue samples are taken from the brain, liver, etc. The test itself is not hard, but the logistics of getting the fish samples (sometimes more than 800 miles away) and returning the results within 48 hours (the time-limit to hold the suspect) to the court are a problem. There is no need to centralise the testing if the logistics are manageable. The sustainable hook-and-line method has been successfully introduced in some areas of the Philippines by providing economic incentives to use this method.

Bob Johannes: The Australian experience is that when the fishermen are trained properly this results in lower fish mortality rates, higher-quality fish and better prices. The Napoleon wrasse is hard to catch with baited hooks or in traps. More research is required to explore sustainable fishing techniques for this target species.

Rili Djohani (TNC): Who is willing to pay for the economic incentives placed on the use of sustainable fishing techniques?

Vaughan Pratt: Cooperatives financed by the Landbank pay more to fishermen using the hook-and-line method. Concerned businessmen are willing to pay more for 'cyanide-free' fish. However, cooperation with exporters needs to be explored: 'green fish need green exporters'.

Kwang-Tsao Shao: Education and awareness programmes are very important. The sensitivity of the test depends on the doses!

Vaughan Pratt: Liver damage in fish indicates exposure to high doses of cyanide.

Recommendation 3:

Ban the possession of cyanide on the boats, as Papua New Guinea has done.

Mick Raga: Cyanide is used in specific industries such as electro-plating but is not acceptable in the fishing industry. Any fisherman in possession of cyanide should be arrested. The use of cyanide is not allowed for fishing in Papua New Guinea (nor is it, in most, if not all countries in the region. Enforcement is the problem. Ed.)

Kwang-Tsao Shao: Cyanide fishing is not a problem in Taiwan.

Observer from UK: Important to have cyanide tests in importing countries as an additional 'stick'.

Vaughan Pratt: The most efficient and feasible approach seems to be to have a system of permits in exporting countries.

Recommendation 5:

Commission a study to determine the kinds of research and development needed to raise selected grouper species and humphead wrasse from the egg commercially in order to reduce the demand for wild-caught fish.

Sumyaryo Sumiskum: Groupers in Bali are already hatched from eggs. The mouse grouper (*Cromileptes altivelis*) fetches especially high prices in Hong Kong. However, hatchery fingerlings still have a mortality of 95 per cent. The programme is successful from a research point of view but not commercially. There are still a lot of problems in cultivating wrasses. The methods used to feed small fry have not been fully worked out yet. Research is currently focussing on feeding methods. Twelve species of groupers have been bred in a hatchery North of Bali (Singaradja area). The company works together with Taiwan.

Bob Johannes: A decade ago more than ten species had already been successfully bred in the region, but there were two major problems: i) the feeding procedures for fingerlings, ii) cannibalism. These problems largely remain. We need to pull expertise together from different companies to advance technology faster. However, such cooperation will be difficult, since most commercial companies are secretive to help ensure their profits.

Kwang-Tsao Shao: The research of the private sector develops faster than from universities, but sharing expertise is a sensitive issue. Fresh-water breeding has been very successful. Some private companies have been quite successful in breeding marine species. They also try to promote cooperation among South-East Asian countries. In this context, there seems to be a contradiction between the recommendation in page 5 of the Johannes and Riepen report to ban the export of fingerlings and the recommendation to promote mariculture.

Bob Johannes said that this was an error that he had overlooked in the report and thanked Dr Shao for bringing it to his attention. The recommendation

should have been to ban the export of wild-caught fingerlings.

Vaughan Pratt: Ninety-two tons of fingerlings were exported last year from the Philippines. In consequence the country now needs to import fingerlings from Malaysia. Therefore, a ban on export of fingerlings is desirable.

Bod Johannes: Recent research reveals that the number of adult reef fish is limited largely by the number of pelagic larvae arriving and settling on the reefs. This contrasts with the widespread intuitive belief that the number of adult fish depends mainly on predation and/or competition on the reef. By removing large numbers of juvenile fish from reefs, there will therefore presumably be a considerable decrease in the adult fish population. This is why the export of wild-caught juveniles should be banned—and their use domestically for aquaculture should be curtailed as fast as aquaculture can provide substitutes.

Chuck Cook: What is the progress of mariculture on humphead wrasse in Taiwan?

Kwang-Tsao Shao: It is difficult to make an assessment. Successful mariculture of snappers and grunts is known in Taiwan.

Pak Naya: In Lampung, there is a research institute from the Department of Agriculture which focuses on the mariculture of the Napoleon wrasse. The cooperation among countries should be enhanced on this matter.

Bob Johannes: Is there anything we can do to accelerate this research? Or is the private sector already progressing as fast as the profit motive permits?

Kwang-Tsao Shao: Governments in the region need to provide more funding for research and publication. However, it is difficult to increase the speed of research in the private sector.

Ling Ling Lee: The market value is an important tool. If the market value increases, automatically an increase of research activities will follow. The Taiwanese Government is building a fish-seed centre for a steady supply of fry both for mariculture purposes and for release to depleted areas. The cyanide ban in Taiwan has been successful partially because the fry of several species are so cheaply supplied by mariculture companies.

Observer from the Cook Islands: It is important to study the market demand and the willingness to accept farmed fish before promoting mariculture



of target fish species extensively. (He suggested making a flow chart of the recommendations and showing relationships with market, export, available resources, enforcement, manpower, etc.)

Observer from the UK: 1. In Europe, the increase of marine fish research led to an increase of demand for farmed fish. 2. The US National History Museum is cautious about distinctions between populations in different areas with regard to mariculture. A mixing of gene pools that might be very distinct may occur. The moving of species to other areas should be carefully thought out.

Bob Johannes: Hong Kong people told him that it would be very hard to change the taste for live reef fish of the people from Hong Kong and South China. And, depressingly, the rarer the food, the higher the demand and thus the higher the price.

Recommendations 7–10:

7) Where logistics permit, set up cyanide detection laboratories (in import destinations such as Hong Kong, as well as source countries) in order to monitor live reef food fish and marine aquarium fish operations, as pioneered in the Philippines.

8) Support research on the effects of cyanide on corals and coral reef communities to get a better idea of their vulnerability and the magnitude of the 'clearcutting' affect.

9) Carry out research to improve non-destructive methods of catching species targeted by the trade.

10) Work with the governments of Indonesia, Thailand, Malaysia and China to ban the use of cyanide in the electro-plating industry and thus reduce its availability, as has already been done in most countries.

Pak Naya: Many thanks to Bob Johannes and The Nature Conservancy on behalf of Minister Sarwono.

He encouraged all colleagues to help deal with the issue. The live reef-fish trade should bring the ASEAN countries together and increase the awareness and cooperation. The live reef-fish trade is neither the problem of a single country nor a single issue.

Chuck Cook and Bob Johannes: A working group—a commission with representatives from the key countries—could be established in the Asia-Pacific region building, upon the expertise of SPREP, APEC and ASEAN.

Peter Thomas: ICRI (The International Coral Reef Initiative) will have a regional coral reef and enforcement workshop in March 1996. The issue can be incorporated in this workshop. Is the demand too high for a sustainable fishery? The recommendations do not target what demand (consumer) countries can generate. How do we draw attention to the issue in those countries? What is the role of countries outside the Asia-Pacific region?

Vaughan Pratt: The Philippines are working daily on the issue and could provide good demonstration sites for the next workshop on the live reef-fish trade. A proposal could be developed to obtain USAID funds.

Ling Ling Lee: The Government of Taiwan has expressed interest in the issue and may come forward to host the next workshop.

Follow-up plans of the State Ministry of Environment and The Nature Conservancy:

☞ to summarise results of the workshop and distribute them to the panellists and to others on request.

☞ to set up a regional working group which will reconvene and communicate periodically to evaluate measurable progress in combatting this destructive fishing practice, share success stories, and develop/implement either regional or country strategies to create sustainable fisheries.



The aquarium fishery in the Cook Islands: 'is there a need for management?'

*by Ian Bertram,
Ministry of Marine Resources,
Rarotonga, Cook Islands*

The following article was presented as Background Paper #14 during the SPC-FFA Workshop on the Management of South Pacific Inshore Fisheries, which was held in Noumea in June/July 1995.

Summary of the fishery

The commercial exploitation of aquarium fish in the Cook Islands was established during November 1988. One foreign-owned company was granted permission to operate on Rarotonga by the Cook Islands Government. Although the operation is relatively small it is an important export earner for the country: earning NZ\$80,000 at its initial stage to present earnings of NZ\$240,000 per year. The operation currently employs 6 full-time and 3 part-time collectors who earn between NZ\$50 and NZ\$700 per week depending on their catch and experience.

Other islands in the Cooks, particularly those with frequent air links to Rarotonga, have the potential for the commercial exploitation of aquarium fish. However, the lack of interest, knowledge and capital has prevented any collecting on these islands. It is anticipated that in the future resources in the outer islands will be utilised.

Due to the variety of fish species collected for the aquarium trade, the biology will not be discussed in this paper. The interested reader is directed to a recent publication by the Forum Fisheries Agency, entitled, *Nearshore Marine Resources of the South Pacific* (Wright & Hill, 1993) for information on the biology and other aspects of the fishery. In the Cook Islands a total of 35 different marine ornamental fish are collected by divers using SCUBA, with either small-meshed barrier or hand-held scoop nets, at depths of eight to 70 metres, however only eight species are in regular demand. Fish captured from deep water are pierced in the air bladder or staged (depending on species) to prevent the need for lengthy decompression procedures.

Cook Islands Aquarium Fish Ltd does not accept ornamental fish caught from the lagoon. Fish are kept in special tanks with circulated fresh salt water on board medium-sized (5-8m) vessels prior to transfer into a warehouse holding facility. To avoid waste build-up during air shipment they are not fed for two to three days prior to shipping.

Problems with the industry

There has been much objection to the establishment and operations of Cook Islands Aquarium Fish Ltd,

from recreational dive operators and the general public, with the principal accusations being:

1. The fish collectors are indiscriminately destroying the coral reef habitat, and
2. The operations of aquarium fish collecting have caused significant depletion of both ornamental and reef food-fish stocks.

Responses by Cook Islands Aquarium Fish Ltd to questions about its operations are attached in Annex1.

Cook Islands Aquarium Fish Ltd accepted that some of their collectors have caused minor damage to the reef unnecessarily during capture of one species of fish. Collectors with frequent destructive fishing practices have been dismissed. Currently the operators maintain that they do their best to monitor their staff and no longer allow inexperienced collectors to collect species which require any coral notching (careful removal of branches from the middle of a coral head) (Passfield & Evans, 1991).

The overall CPUE (all species pooled) has remained consistent after 1990 as illustrated in Figure 1. This suggests that resources are sustainable with the current levels of exploitation.

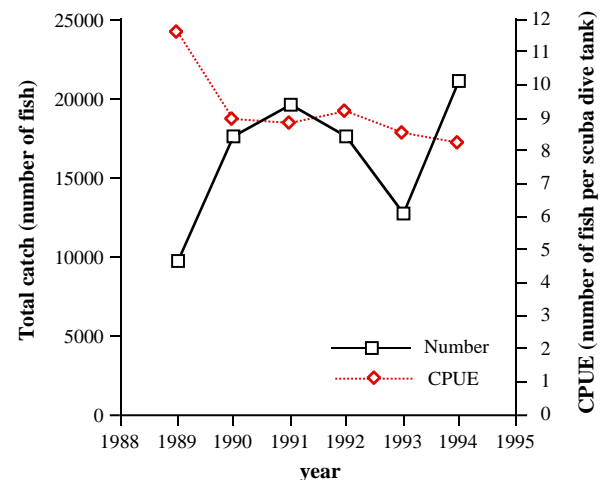


Figure 1. The history of overall catch (numbers of fish) and effort (dive tanks per year), extracted from annual records supplied by Cook Islands Aquarium Fish Ltd

Management of the fishery

At present the fishery is not governed by any regulations which are designed to limit the total catch or effort, since no distinct decline in catch rates has been detected. Management is limited to a ban on fishing in the lagoon by the expatriate fish collectors. However, there are no regulations covering local Cook Islanders fishing inside the lagoon (FFA Report No. 93/25).

Future trends

With only one exporter operating at the present time on Rarotonga, and assuming fishing practices do not change, no management (e.g., catch quotas, harvest seasons, etc.) appears to be necessary. However, to avoid further conflicts between the different user groups (i.e. fishermen, aquarium fish collectors, recreational divers, conservationists, etc.) there is an urgent need to address the social goals in fisheries management. It is prudent that management guidelines be established prior to the expansion of industry.

The future management strategies are likely to incorporate the following components:

- ☞ That only one operator be granted permission to commercially exploit marine ornamental fish on each island which has sufficient stocks and infrastructure to establish a viable fishery.
- ☞ That licences be issued to aquarium fish exporters. Conditions for the issue of licences should include:
 - *The exporters have a good international reputation, and catch and effort statistics are made available;*
 - *A code of fishing practices be established and that the operator be responsible for ensuring that collectors follow this code. The code should include ecological considerations and also qualifications for collectors (approve minimum standards for collection methods);*
 - *That permanent marine reserves located around the islands be designated, where fishing in general is prohibited. These reserves may be selected for their aesthetic appeal where recreational divers can observe fish in an undisturbed habitat.*

These recommendations for management of the aquarium fishery should minimise the conflicting issues between different user groups, avoid over-

fishing, and maintain economic benefits to the country.

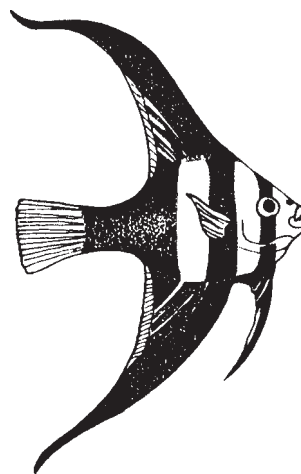
Conclusion

Establishing management guidelines for aquarium fish is high on the agenda if exploitation is expanded to outer islands within the group. It is anticipated that these regulations will be designed to achieve the following goals: encourage development, ensure that only clean, recognised operators are given permission to operate, avoid conflicts between different user groups (fish collectors, spear fishermen, conservationists, recreational divers, etc.).

In summary, the Cook Islands experience with a recently developed fishery for aquarium fish has been a success, in terms of creating employment, fisheries development and self-imposed management. No detrimental biological effects on the resources have been detected.

References

- PASSFIELD, K. & J. EVANS (1991). Aquarium Fish Profile, Ministry of Marine Resources Profile No. 7. Rarotonga, Cook Islands.
- RICHARDS, A. (1993). Cook Islands Fisheries Resources Profiles. Research Coordination Unit. FFA Report No. 93/25. 121 p.



Annex 1: Responses by Cook Islands Aquarium Fish Ltd to questions concerning its operations.

Coral head 'notching' and the real causes of reef damage

- Only one species of fish, *Neocirrhites armatus* (Red Hawks), requires coral notching in order to successfully collect it. This species lives in

only one type of coral (*Pocillopora*), out of over 40 different types of coral on Rarotonga's reefs. Thus, the 'notching' of this one type of coral is a small percentage of the entire coral reef.

- The reef around Rarotonga covers over 32 kilometres and coral is notched in only a three to four kilometre section of the 32 kilometres. The 'notching' is done on only one of over 40 types of coral in this three to four kilometre area.
- The majority of 'notched' coral heads do not die. They remain alive, filling the notched areas with new growth of branches.
- The branches from the notched coral head grow when planted and produce additional coral heads.
- Scientific studies show that the end result of the 'notching' of coral heads and planting of coral branches increase the total number of coral heads on the reef, as *Pocillopora* has a life span of 15 years. The technique of notching helps to maintain the population.
- The causes of extensive damage to Rarotonga's coral reefs have been and will continue to be cyclones and water pollution, not damage to individual coral heads, whether it be the result of boat anchors, sport divers, shell collectors or fish collectors.
- Coral reefs recover from damage caused by cyclones in about 8 to 10 years. New coral grows from broken pieces left by the cyclone, and larval coral produced by the remaining live coral through the reproduction process.
- Coral reefs do not recover from water pollution, they remain dead unless the water pollution is stopped. The amount of time needed for a polluted reef environment to re-grow, once the pollution is stopped, is much longer than the recovery time after a cyclone.

Type of fish collected and effects on 'food fish'

- The aquarium fish are not the types caught for food.
- The number and type of aquarium fish collected do not affect the 'food chain' of the edible fish on the reef: algae eaters such as parrots and surgeons do not prey on other reef fish.

- The majority of the fish are caught entirely by locally-trained collectors.
- The aquarium fish which are caught are not a food source for large fish caught trolling and do not affect the population of those fish. Tuna and barracuda do not feed on ornamental reef fish, as trolling methods prove.
- Small ornamental reef fish recruit and grow within a few months, as collection numbers prove.

Aquarium fish resources and Cook Islands Aquarium Fish Ltd

- The aquarium fish are sold overseas and bring foreign money into the country.
- The aquarium fish replenish quickly (6-14 months) and provide an unending source of money when managed correctly.
- At present Cook Islands Aquarium Fish Ltd buys fish from six full-time and three part-time self-employed fish collectors, trained by the company.
- The company employs one part-time warehouse worker.
- Cook Islands Aquarium Fish Ltd., since it was started in November 1988, has trained or attempted to train 42 Cook Islanders for positions in warehouse management, maintenance and fish collecting. Up to the present time the company has been unable to find persons interested in attempting the five-year training period required to manage the warehouse and export phase of the business.
- In response to accusations that Cook Islands Aquarium Fish Ltd is unlawfully operating without local partnership or investment: As provided for in the Cook Islands Development Investment Act and Investment Code, Cook Islands Aquarium Fish Ltd is a foreign-owned company. Nowhere does the Act of the Code state that a foreign company investing in agriculture or fisheries **must** have local partnership.



Managing Palau's aquarium life fishery

by Tom Graham,
Division of Marine Resources,
Palau

The following article was presented as Background Paper #35 during the SPC-FFA Workshop on the Management of South Pacific Inshore Fisheries, which was held in Noumea in June/July 1995.

History of the fishery

Exports from Palau of aquarium life were started by a locally-owned company in 1991. Since that time, there has never been more than one company operating at a time, although that company changed hands in 1993. The national government's Palau Mariculture Demonstration Centre has also been involved in the trade, but its business has been limited to cultured giant clams, and, more recently, soft corals.

Accurate production figures for the private sector are not available, but the scale of Palau's aquarium life industry is illustrated in the following rough estimates of 1994 exports¹.

| Item | Number of pieces | Gross receipts (US\$) |
|---------------|------------------|-----------------------|
| Finfish | 100,000 | 80,000 |
| Invertebrates | 40,000 | 120,000 |
| Total | 140,000 | 200,000 |

A total of about 200 species of finfish and 100 invertebrate species were exported in 1994. Among the finfish, the top ten species comprised about 60 per cent of the total number exported.

Management of the fishery

Palau's national congress recently passed the *Marine Protection Act of 1994*. The law places significant restrictions on the use of Palau's inshore marine resources, including restrictions on the harvest, sale, purchase, and/or export of 26 species of food fish. The Act also requires the promulgation of regulations 'regarding the taking and export of fish for aquarium purposes.' This provision was made because of widespread public concern about the potentially negative impacts of the aquarium fishery. Many local fishermen, for example, saw the aquarium industry as unwanted competition for food fish. Recreational divers viewed the industry as destroying the reef by removing fish and corals. There were also questions about why foreigners

were doing the collecting rather than Palauans, and about who exactly was benefiting from the fishery.

Palau's Ministry of Resources and Development spent about six months formulating regulations, and in December 1994, the *Regulations on the Collection of Marine Resources for Aquaria and Research*² became effective.

Described below are the main elements of those regulations and the major management issues of the fishery. Because the regulations have not yet had time to be adequately tested, little discussion is included here on how well they have met their objectives.

Management objectives

The following set of objectives was used to guide the formulation of the regulations:

- To encourage a prosperous and sustainable aquarium life industry;
- To encourage participation in the fishery by Palauans;
- To ensure that the resource owners receive fair compensation for the use of their resources; and
- To ensure that other potential benefits from those resources, including ecological and recreational benefits, are not unduly compromised or lost.

Summary of regulations

- Any person taking more than five pieces of aquarium species in a single day must be the *holder* of an *Aquarium Collecting Permit*.
- Any person exporting from Palau any aquarium species must be the *owner* of an *Aquarium Collecting Permit* (each permit is issued in the names of both a permit *holder* and a permit *owner*).

¹. These estimates are based on a variety of data compiled by Palau's Division of Marine Resources, including data provided by the industry, air cargo export records and inspection records.

². In addition to regulating the collection and export of aquarium species, these regulations also address the collection of marine organisms for science and marine-related research in general. Those aspects of the regulations are not discussed here.

- Starting in January 1997, only Palauan citizens will be eligible to obtain *Aquarium Collecting Permits* as permit holders.
- No more than 20 *Aquarium Collecting Permits* will be issued in any given year, and permit applications will be evaluated based on a set of criteria that include previous experience in the business, compliance with relevant laws, and contributions to marine life conservation efforts.
- An *Aquarium Collecting Permit* is considered valid only when endorsed by the proper authority of the State in which aquarium fish are being collected.
- Hard corals (including 'live rock'), giant clams, and sponges may not be exported.
- Exemptions to these restrictions are provided for cultured specimens, specimens collected from permitted dredge sites, and specimens collected for permitted research purposes.
- The only fishing gears that may be used to collect aquarium species are barrier nets, drop nets and hand nets.
- The national government may at any time further restrict the collection or export for aquarium purposes of any species of marine organism, such as through a ban or a daily or annual bag limit or quota.
- All exports of aquarium species are to be inspected by the national government.
- Owners of *Aquarium Collecting Permits* must report their catches and exports.
- Penalties for violations of the regulations range from a US\$250 fine for the first conviction up to a US\$10,000 fine and a one-year jail sentence for any conviction after a third conviction.



attached to individual fishermen rather than to vessels or companies. The regulations place a cap of 20 permits to be issued in any given year. This number is based on the recommendations of several fisheries experts from the Pacific region, and on historical participation in the fishery (between 5 and 15 full-time collectors were typically active in the past).

Given that some permit applications will potentially have to be denied, one difficult issue was deciding how to choose among applicants competing for limited spots in the fishery. Options included first-come-first-served, a weighted lottery (with those having greater prior participation in the fishery earning more lottery tickets), and case-by-case application review. The latter method was adopted, with the Minister of Resources and Development given the authority to grant and deny competing applications based on a list of fairly loose criteria. The criteria include past experience in the business, previous compliance with relevant laws and regulations, previous compliance with reporting and inspection requirements, contributions to marine life conservation efforts, and date of application.

In keeping with the goal of issuing permits only to those with desirable track records in the business, it was decided that the permits would not be freely transferrable.

However, in order to give businesses some flexibility, such as allowing for employee turnover, the permits would be transferable to a certain extent. While each permit would be issued in the name of an individual collector (the permit holder), the permit would also bear the name of another party, the permit owner, which could be the collector himself, a business (such as the collector's employer), or any other entity. A permit owner could apply for and be granted any number of permits.

Thus, a permit could be transferred among holders but not among owners, allowing for some flexibility in the operations of aquarium businesses that 'own' a number of permits. This system would also help preserve opportunities for inexperienced newcomers to the fishery.

For example, an individual with no previous experience in the fishery might have a difficult time being granted a permit under the determining criteria described above. But by initially finding a

Limited entry permit system

The key feature of the regulations is the establishment of a limited entry system, with entry into the fishery controlled through permits issued by the national government. Because the main purpose of the system is to limit fishing effort, the permits are

sponsor of sorts in an established company—working, for example, either as an employee of the company or simply as an independent supplier to the company—the individual could collect aquarium fish as a permit holder, gaining experience at the same time that could facilitate his eventually becoming a permit owner.

The government's interest in ensuring a 'clean' fishery—with only environmentally responsible collectors in the water—is reinforced in the provision that 'permit owners are considered responsible for the conduct of all permit holders, employees, agents or anyone acting under their general supervision, with respect to permits they own.'

Another responsibility borne by the permit owner and not the holder is the regulation's catch reporting requirements. Finally, while only a permit holder is allowed to collect aquarium fish, only the permit owner is allowed to export them (no permit is needed to buy or sell aquarium fish).

What are 'aquarium species'?

One difficult issue, especially from the enforcement standpoint, was to identify exactly what activities would require the permit described above. That is, how could 'aquarium fishing' be legally differentiated from other types of fishing? One option was to regulate the act of collecting organisms that were to be used for a particular *purpose*—that is, for keeping in aquaria. The difficulty there would be in being able to prove that fish collected in violation of the regulations were indeed to be kept in aquaria. The other option was to regulate the collection of particular *species*.

While legally more straightforward, this option presented the somewhat complex task of describing which species were to be subject to the regulations—that is, defining which species were 'aquarium species'. This latter option was finally adopted, in part in order to remain consistent with the approach of Palau's other marine-related laws, including the *Endangered Species Act* and the *Marine Protection Act*, both of which regulate the use of particular species.

The aquarium regulations define 'aquarium species' as those species identified on a list called the *Regulated Marine Species Register*, which may be amended from time to time by the Division of Marine Resources.

The Division attempts to include on the register all vertebrate and invertebrate species that are popular in the aquarium trade but that are not popular locally as food fish³.

Palauan versus foreign participation

Another difficult issue in the management of the fishery (and throughout the economy of Palau) was whether or not foreign ownership and/or participation should be controlled. Like any other business in Palau, the aquarium life industry is subject to the *Foreign Investment Act*, which controls foreign-owned businesses through a licensing system, and places conditions on the employment of foreigners in those businesses.

Marine-related occupations—particularly fishing—appear to be especially sensitive in terms of foreign versus local participation, no doubt in part because of Palauans' traditional heavy reliance on the resources of the sea and the strict and complex restrictions that have traditionally been placed on their use.

The policy was made in the aquarium regulations that within two years of the effective date of the regulations, participation in the aquarium fishery would be limited to Palauan citizens. This restriction, which becomes effective in 1997, will apply only to permit holders and not to permit owners, and thus will not necessarily affect ownership of aquarium fishing businesses or their shoreside employees.

National versus state jurisdiction

Palau's Constitution states that 'each state shall have exclusive ownership of all living and non-living resources, except highly migratory fish, from the land to twelve (12) nautical miles seaward from the traditional baselines; provided, however, that traditional fishing rights and practices shall not be impaired' (Republic of Palau Constitution, Article I).

At the same time, some jurisdiction over those resources is exercised by the national government, particularly through the provisions of the *Marine Protection Act*. There appears, therefore, to be potential for conflict between the national and state governments over jurisdiction of inshore resources.

³ Although the taking of food fish for aquarium purposes is not explicitly prohibited, it is discouraged through a provision of the *Marine Protection Act* that prohibits the use of scuba or hookah while fishing except by special permit. The government may, for example, choose to permit the use of compressed air to take aquarium species — that is, species not popular as food.

The approach taken in drafting the aquarium regulations was to give some recognition to the states' authority in the permit system. An *Aquarium Collecting Permit* is considered valid (by the national government) only if endorsed by the appropriate authority in the state where collecting is being done. Obtaining this endorsement is the responsibility of the permittee.

The states also have the clear authority to impose any additional permits, restrictions, conditions, or fees on fishing of any sort, and some states do have general fishing permit systems in place.

The *Marine Protection Act* authorises the national government to charge fees only for expenses incurred in administering the Act, such as those associated with processing permits, inspections, and so forth. The annual fee for an *Aquarium Collecting Permit* is US\$100. While the national government may thus only collect 'management fees', there is nothing to keep the state governments from collecting more substantial compensation from aquarium collectors—something more like 'resource rent'.

Trade in endangered species

Palau currently does not have a list of threatened or endangered species under its *Endangered Species Act*. Several animals popular in the aquarium trade are, however, listed in the appendices of the *Convention on International Trade in Endangered Species of Fauna and Flora* (CITES). Although Palau is not yet a signatory to CITES, the export of these species to signatory countries must comply with their CITES implementation laws. Hard corals and giant clams are listed on Appendix II of the convention, so their trade is regulated, but not prohibited. For example, what the US requires from non-party countries for Appendix II species is simply export documentation certifying that the shipment satisfies all the laws of the exporting country⁴.

Palau's new aquarium regulations do, in fact, place special restrictions on the export of giant clams and hard corals. Exports are allowed only for specimens of hard coral that have been: 1) cultured, 2) taken incidentally in permitted dredging opera-

tions, or 3) allowed under the terms of a *Marine Research Permit*. The *Marine Protection Act* prohibits the export of giant clams, except cultured specimens.

The trade restrictions on giant clams have not unduly hindered their export for aquaria since Palau has a source of competitively-priced cultured giant clams. The coral restriction, however, has had more of an impact, since nobody in Palau is currently culturing hard corals on a commercial scale. There are at least four aquarium and curio products that are affected by the restriction: 1) live hard corals, 2) dead coralline rock covered with live algal and other growth, known in the trade as 'live rock', 3) live soft corals, which are 'planted' on small pieces of dead coralline rock⁵, and 4) dead hard corals sold as decorative pieces.

The local aquarium industry exported significant quantities of wild corals and live rock in the last few years⁶. It has also grown out hard corals on an experimental scale, and it wanted to know whether or not those products would be considered 'cultured' and thus exempt from the export prohibition.

Exemptions for 'cultured' organisms

The decision to allow the export of only cultured giant clams, hard corals, and sponges was a straightforward one, but deciding just what would constitute a 'cultured' animal was not so simple. After considerable debate with the industry, which naturally argued for a fairly loose definition of 'cultured', the definition finally adopted was that recommended in CITES for the term 'bred in captivity'⁷.

To paraphrase the CITES definition, 'bred in captivity' would refer only to:

- offspring that were born or otherwise produced in a controlled environment, of parents that transferred gametes in a controlled environment (if reproduction is sexual) or that were in a controlled environment when development of the offspring began (if reproduction is asexual); and where:

⁴. Up until 1 October 1994, the date of Palau's independence from the US, trade between Palau and the US mainland was domestic, and so was not subject to CITES.

⁵. Other substrates, such as basalt rock, are sometimes used, but coralline rock is apparently preferred for both its appearance and its superior binding properties for the soft coral.

⁶. It is estimated that aquarium life exports in 1994 included 1,300 pieces of hard coral, 8,000 pounds of live rock and 8,000 pieces of soft coral (based on data compiled by Palau Division of Marine Resources).

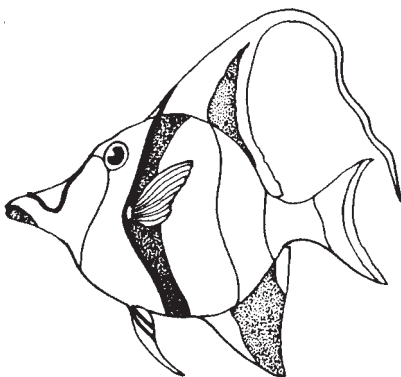
⁷. In the context of CITES, the term 'bred in captivity' is used to provide exemptions from trade restrictions for Appendix I animals. It is not relevant to Appendix II animals such as giant clams and corals, the trade of which is not prohibited by the Convention.

- *a controlled environment is one that is intensively manipulated by man for the purpose of producing the species in question and that has boundaries designed to prevent animals, eggs, or gametes from entering or leaving the controlled environment; and finally;*
- *the parental breeding stock must be managed in a manner designed to maintain the breeding stock indefinitely.*

Although the exemptions for cultured specimens and specimens taken from permitted dredge sites are consistent with the aim of making 'best use' of the resources, they also pose some problems for enforcement. How are enforcement personnel to differentiate illegally taken specimens from cultured products or specimens taken from permitted dredge sites? The regulations require documentation from the Division of Marine Resources certifying cultured products as such, and place the burden of proof on the producer. In other words, in order for a piece of coral to be legally considered cultured, it must not only be cultured in fact, but the government must also be convinced that it has been cultured.

The Division of Marine Resources has issued guidelines for providing evidence that a product was cultured or taken from a permitted dredge site. The guidelines recommend that the government be invited to inspect all culture facilities and methods, that photos be taken of as much of the process as possible, and that invoices for all materials purchased, such as dredge spoils, be maintained. Pursuant to a provision of the *Marine Protection Act*, these guidelines will eventually have to be translated into regulatory law.

A single one-page form, called the *Marine Resource Export Certification*, is being used to serve most documentation needs of the aquarium regulations and related laws. The document serves as a certificate of origin, a certification of culture, and/or as an in-lieu export certification pursuant to CITES.



Contentious issues

There were three elements of the regulations (when they were being proposed) that brought objections from the aquarium life industry: 1) the Palauan-collector-only provision, 2) the export restrictions for hard corals and live rock, and 3) the definition of the term 'cultured'.

According to the regulations, only Palauans would be allowed to collect aquarium fish starting two years from the effective date of the law. The two-year delay was intended to allow the industry time to turn over its staff and to train local collectors. The aquarium company, which is Palauan-owned, has had a mixture—both shoreside and in the water—of Palauan and foreign employees (38% Palauan in 1994).

The company claimed to agree with the policy of encouraging participation by Palauans in the fishery, but it opposed the outright ban on foreign collectors. It proposed an alternative policy that would limit the proportion of foreign workers in any aquarium life business to no more than 30 per cent of the total number.

The business would then have the flexibility of deciding how to use the foreigners; that is, to collect fish or to perform other jobs. This alternative was rejected by the government, and the prohibition on foreign collectors was adopted in the regulations.

The government's decision was based not only on its policy of encouraging employment of Palauans in businesses in general, but also on the premise that certain occupations need to be protected for Palauans. Water-based occupations, especially fishing, are particularly sensitive in this regard.

The second contentious issue was the prohibition placed on the export of hard coral and live rock. The industry argued against the restrictions on several fronts.

First, it pointed out that corals are renewable resources that can be harvested sustainably. It also tried to illustrate that the environmental impacts of a selective live rock 'fishery' would be less than those of the widespread (and legal) coral dredging operations (primarily for construction material).

It also argued that live rock (exported at US\$1 to US\$2 per pound [US\$2.2 to US\$4.4 per kilo]) constituted a better use of coral rock than did construction material (sold locally for less than US\$0.01 per pound [US\$ 0.02 per kilo]).

In response to these arguments, the government provided an exemption for hard corals or live rock that are taken incidentally to permitted dredging operations. The idea was that the aquarium industry might be able to negotiate with the dredging industry to remove the valuable top layer of hard corals and live rock before the dredgers moved in. This exemption would also provide for a cheap supply of coral rubble (coral rubble is a popular substrate for soft corals in the aquarium trade).

The third issue was the definition of 'cultured'. The industry lobbied for a fairly loose definition of 'cultured', arguing, for example, that *Acropora* branches clipped from wild colonies and subsequently grown in tanks for several weeks or months should be considered cultured. The industry also wanted to be able to lease areas of reef from the states, and argued that anything produced in such an area should be considered cultured.

The government's coral and rock export prohibitions were aimed at limiting the impact of the industry on coral resources to near-zero. It therefore opted for a more strict interpretation of the term 'cultured', and finally adopted the definition of 'bred in captivity' recommended by CITES. Although this definition is fairly strict, it does not preclude the possibility of farming corals or live rock in open reef areas. The key elements of the definition are simply that the organisms reproduce in a controlled environment and that the brood stock be managed to last indefinitely.

Conclusions

In adopting its *Regulations on the Collection of Marine Resources for Aquaria and Research*, the government of Palau has taken a significant step towards proactive management of its inshore resources.

A primary aim of the regulations is to minimise detrimental impacts to Palau's reef systems. The basic strategy is to put a cap on fishing effort so the industry does not expand out of control. If any species are found to be in need of special protection, the regulations are flexible enough so that additional controls on particular species can be put in place as needed.

The regulations also aim to manipulate the flow of benefits from the fishery, first by prohibiting foreign collectors, and second by providing a framework for the states (i.e. the villages) to control collecting in their waters and to levy access fees.

Less than one year has passed since the regulations went into effect, so it is not yet clear how well they are serving their objectives. The public is still learning about the regulations, and the national and state governments are still gearing up to fully administer and enforce them. In any case, the approach embodied in the regulations will serve as a precedent, if not a model, for more active management of Palau's other commercial fisheries.

Environmental, economic and social implications of the fishery for live coral reef food fish in Asia and the Western Pacific

by Bob Johannes & Michael Ripen

Summarised below is a just-released 33,000 word report on the environmentally devastating but not widely recognised live reef food-fish trade that is spreading for thousands of miles from its centre in South-East Asia. The report is based on an investigation which took the authors to nine countries in the region and involved interviews with several hundred individuals, including fishermen, divers, dive tour operators, social and biological researchers, members of national and international NGOs, live reef food-fish exporters and importers, government officials, aquaculture experts, fish farmers and village leaders.

Copies of the full report can be obtained from Carol Fox of the Nature Conservancy in Honolulu, Fax: (1) 808 545 2019. For more information contact, Dr Bob Johannes, 8 Tyndall Court, Bonnet Hill, Tasmania 7053, Australia, Phone: (61) 2 298 061, Fax: (61) 2 198 066 (e-mail: bobjoh@ice.net.au).

Scale of the industry

Growing economic prosperity in Asia has prompted the rapid and continuing expansion of the market for live reef food fish. Humphead wrasse (also known as Napoleon or Maori wrasse) and the highfin grouper (also known as polka dot grouper, barramundi cod, panther or mouse head), are the

most highly-valued species. Prime, plate-sized specimens sell to Hong Kong consumers for as much as US\$180 per kilogram. Next in value are the variety of other groupers (coral cod and coral trout).

The industry currently exports an estimated 25,000 tonnes of live reef food-fish per year, with about 60 per cent from wild capture.

The export trade is estimated to have an annual wholesale value of about US\$1 billion. Hong Kong is the largest consumer. But it is in Southern China, with its rapidly expanding economy, that demand is growing fastest. Figures are not available for domestic trade in the region, but it may be substantial. There are more Chinese in Indonesia, for example, than in Hong Kong.

Destructive fishing practices

The premium prices paid for these fish are encouraging the use of a fishing practice that is causing the widespread devastation of the world's richest coral reefs. Divers chase target fish into holes in the reef, then squirt a solution of the extremely toxic chemical sodium cyanide into the holes. This immobilises the target fish so that they can be easily captured. They are then revived and ultimately transported live to market, by ship or air.

Cyanide affects far more than just the target species. Smaller fish, and shellfish, are less resistant to cyanide. Many die for each target fish captured. Moreover, corals, which provide the basic foundation of reef community, also bleach and die. This has the same effect on reef life as clear-cutting trees has on forest animals; it destroys their habitat and they disappear.

As reef fish stocks dwindle, the use of cyanide by impoverished fishermen who are heavily dependent upon reef resources often becomes increasingly indiscriminate. While quart-sized squirt bottles are normally used to administer the poison, in some cases fishermen have dumped whole 55 gallon drums of the poison into shallow reef communities, transforming them into aquatic graveyards.

While devastating to reef communities, cyanide rarely reaches concentrations in target fish that are thought to be toxic to human consumers.

Intensive hook-and-line fishing for the live fish trade has also eliminated large spawning aggregations of groupers that have sustained coastal villagers for centuries. This has been recorded in Palau and also reported from Papua New Guinea. Because spawning aggregations are exceptionally vulnerable to depletion, it is possible that many others have been eliminated without record.

Geographic spread of the problem

The extent of the damage and the speed with which these practices are spreading are alarming. Fish buyers in Hong Kong and Singapore say that the

target species have been heavily depleted in the Philippines. A growing number of fishing grounds in Indonesia have been plundered and abandoned by the industry, and buyers estimate that within three to four years Indonesia's commercially harvestable stocks of target groupers and wrasse will also be largely exhausted. They say they look upon Papua New Guinea as their next major source.

Live reef fish are currently being caught for the Hong Kong and China markets from as far away as Vanuatu in the Pacific Ocean to the east and the Maldives in the Indian Ocean to the west, revealing the industry's wide geographic reach. It now encompasses an area stretching over one quarter of the world's circumference and containing one-third of the world's coral reefs. Areas affected include the most biologically diverse marine habitats in the world; the Philippines and Indonesia contain about 35 per cent of the world's fish species and well over 50 per cent of the world's reef coral species.

No slowing of consumer demand nor of the geographic expansion of the fishery is in sight.

Threat to divers

Fishing companies supply cyanide fishermen with air compressors for their diving but often neglect to give them instruction in their use. As a result, death or paralysis due to the bends has become widespread. Fishermen say the frequency of such accidents continues to increase as they find themselves forced to go deeper and stay down longer to get fish, after depleting stocks in shallower waters.

Among the 200 divers in one Filipino community, 30 got the bends and 10 died in 1993 alone. A recent informal survey in the Philippines revealed that in seven out of eight small coastal communities contacted, one or more divers had died due to the bends within the past three years.

Long-term effects on villagers

Coral reefs are vital to the lives of the coastal villagers of the region. By degrading or destroying these reefs for short-term gain, fishing companies are trading away their future.

Once seriously damaged, reef communities typically take several decades to fully recover—under favourable conditions. But it is unlikely that conditions will be favourable in many such areas, especially in South-East Asia. For centuries, villagers in the region have depended upon reef fish for their livings, as well as their main source of animal protein.

Today 80 per cent of Filipino coastal fishermen's families are under the official poverty line. A similar percentage are undernourished. Coastal populations in the region continue to rise.

The edible fish and invertebrates that begin to recolonise cyanided reefs are thus sought with increasing urgency. Understandably, under such conditions, fishermen are motivated to use any method available to catch fish to feed their families. As long as such conditions persist, their reef communities cannot recover.

The importance of village-based control of the fishing grounds

In South-East Asia the fishing companies often operate at will because local villagers (often the only witnesses to their activities) are powerless to intervene—either because the law does not recognise their right to do so, or due to poor communications or bribery of local officials. Many Pacific Island countries have somewhat better chances of protecting their marine resources because traditional village control over local fishing grounds is well-developed and often receives official government support.

The only places in the region where some effective control was being exercised over live reef fishing companies on the fishing grounds during this study were found to be those where villagers possessed some form of enforceable rights to local marine resources. Such rights provide an essential incentive for conservation. To be more effective, however, they need government support by means of supporting legislation, environmental education, and training and deputising of village fishermen for fisheries law enforcement.

The goal: sustainable fisheries—meeting the demand without destroying the supply

Catching and keeping fish alive for the live reef food-fish trade is a 'value-adding' form of fishery that need not deplete reef resources. We believe, therefore, that the trade should not be eliminated, but rather converted to sustainable operations. All stakeholders would benefit in the long run—consumers, the industry, fishermen and their families, as well as tourists and tourism. Specific recommendations to this end include the following:

1. Convince government regulatory agencies that the live reef food-fish trade is a distinctive form of fishery requiring special controls;

2. Provide villagers with the incentive to protect their marine resources by giving them the legal right to exclude outsiders from their fishing grounds, or, where that right already exists, provide stronger government backing. Train, deputise and support selected village fishermen as fish wardens;
3. Ban the possession of cyanide on boats, as Papua New Guinea has done;
4. Declare a moratorium on all fishing for live reef fish in areas where stocks are depleted, as parts of the Philippines (e.g. Palawan) have done;
5. Commission a study to determine the kinds of research and development needed to raise selected grouper species and humphead wrasse commercially from the egg in order to reduce the demand for wild-caught fish;
6. Instruct live reef fishing companies on inexpensive ways of reducing very high mortality rates of live reef fish due to unsatisfactory catching, holding and shipping practices;
7. Where logistics permit, set up cyanide detection laboratories (in import destinations such as Hong Kong, as well as source areas) in order to monitor live reef food fish and marine aquarium fish operations, as pioneered in the Philippines;
8. Support research on the effects of cyanide on corals and coral reef communities to get a better idea of their vulnerability and the magnitude of the 'clearcutting' affect;
9. Carry out research to improve non-destructive methods of catching species targeted by the trade;
10. Work with the governments of Indonesia, Thailand, Malaysia and China to ban the use of cyanide in the electro-plating industry and thus reduce its availability, as has already been done in most countries;
11. Ban the export of wild-caught fingerlings of target species.

The research was supported by the Nature Conservancy and the South Pacific Forum Fisheries Agency, as well as a fellowship from the Pew Foundation awarded to the senior author.

Dead corals in exchange for live fish exports?

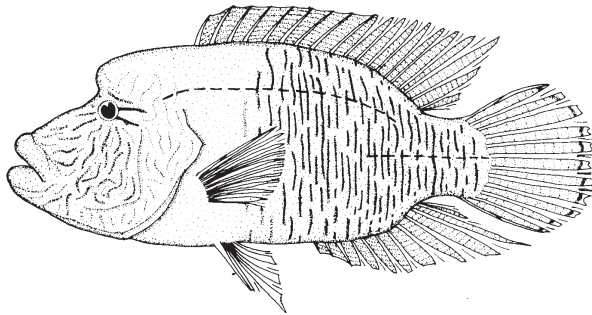
by *Aquilino A. Alvarez Jr.,
Editor,
Marinelife*

This article was originally published in Marinelife (Vol. 2, No. 1, 3rd quarter 1995), a publication of the International Marinelife Alliance – Philippines

Hong Kong's insatiable demand for live food fish is altering the mode and pattern of coral reef destruction in the Philippines.

In Palawan and Zamboanga and the few remaining areas with healthy coral reefs, fishing with explosives is becoming passé as fishermen shift to cyanide fishing to cash in on the vibrancy of the live fish market.

'These days,' reports the International Marinelife Alliance-Philippines (IMA), 'fishermen are paid as much as P350* for a kilo of live **lapulapu** (grouper) and twice as much for a kilo of live **mameng** (humphead wrasse). They get P70 when the fish is dead and frozen.'



The middlemen, in turn, sell the fish to Manila-based exporters at an average price of P900 a kilo. The IMA, a non-governmental organisation, estimates that after deducting the cost of air freight, packing and other handling expenses, the middlemen make a per kilo net profit of P200.

Records from the Bureau of Fisheries and Aquatic Resources (BFAR) reveal that the live fish trade has become a multi-million-dollar industry. During the first six months of this year alone, 19 local companies exported a total of 479,000 kilos of live groupers and wrasses with an estimated value of nearly US\$30 million.

In a country where fishermen are among the poorest of the poor, the bonanza has provoked an epidemic of disdain for blast fishing and promoted, in inverse proportion, the popularity of live fish harvesting techniques.

'The problem,' says the IMA, 'is that the Philippine live fish industry is largely dependent on the use of sodium cyanide, one of the world's most lethal poisons.'

Although coral reef fishes can be effectively caught with traps, nets and hook and-line, the majority of live fish collectors prefer to use cyanide to cut short the 'hunting' process.

The poison stuns the fish, causing them to lose equilibrium, and become, in a manner of speaking, helpless sitting ducks waiting to be picked.

Mother of cyanide fishing

The aquarium fish trade is widely regarded as the 'mother of cyanide misuse' in fisheries. From the '60s to the late '80s, when the Philippines reigned as the number one supplier of decorative fishes in the world market, the kind of net suitable for aquarium fish collecting was never available in the local market as its use was illegal, being of the fine mesh variety.

Although the law was amended in 1986 to decriminalise the use of fine mesh net in aquarium fishing, supply remains practically nil.

Local net manufacturers cannot see a market for 'aquarium fishing net' as the target users are known to be deeply hooked on cyanide use.

The Haribon Foundation estimates that there are more than 4,000 cyanide-using aquarium fish gatherers in the Philippines. Another 2,000, according to the IMA, are engaged in live food-fish collection.

Collectively, these 'search and destroy' fishermen spray nearly 400,000 kilograms of sodium cyanide on coral reefs annually.

Although sale of the broad spectrum poison to fishers is illegal, an underground cyanide distribution network has been spawned by the brisk demand, especially in remote coastal areas.

* 1 P = US\$0.04

In Tawi-Tawi and Jolo, for example, a kilo of cyanide is retailed at P305 per kilo, more than four times the cost in Manila.

Silent killer

A BFAR study established that two applications of cyanide, done four months apart, killed corals in tested quadrants off the island of Cebu.

The coral heads initially took on a bleached appearance and later became encrusted with algae. Algae are telltale signs of dead coral reefs.

The UP Marine Science Institute reported that as recently as 15 years ago, only six per cent of the country's 33,000 square kilometres of coral reefs remained in excellent condition.

The remaining 70 per cent were in various stages of deterioration. *Newsweek*, in a special report on the environment last June, placed the number of killed corals at 90 per cent.

While a significant percentage of this damage is inflicted by explosives, cyanide fishing certainly shares a big part of the blame.

Unlike explosives, which blow corals to smithereens, cyanide keeps coral structures intact but dead.

Dead corals yield no fish and this explains the phenomenon of poverty and hunger sweeping Philippine coastal villages.

Filemon Romero, vice-president of IMA and former chancellor of the Mindanao State University in Tawi-Tawi, said 'coral reefs are a veritable food factory, a provider of food and income, and a critical component of the nation's food chain.'

'Their degradation has cost the country a lot in terms of fish production losses, diminished income opportunities, and high incidence of malnutrition, undernourishment, unemployment and urban migration.'

'The irony of it all,' laments J. Emilio Reynoso, working chair of the Presidential committee on oil spill prevention, 'is that the economic spinoff of cyanide fishing is shared only by a few thousand fishermen and a handful of export companies whose investment plan in the country is obviously not long-term.'

Ecosystem under siege

Palawan has become the center of cyanide fishing because of the widespread devastation of marine

resources elsewhere. Alarmed, the provincial leadership of Palawan enacted a five-year ban on live fish collection in the whole province effective February 1993.

After just over a year, however, the authors of the ban, in a move severely criticised by NGOs, modified their stand by exempting live groupers and other food fishes. Only the ban on aquarium fishes and **mameng** (humphead wrasse) stays.

Mr Reynoso believes a deadly combination of greed for short-term profit and corruption is the driving force behind the tragic turn-around.

'As a certified multimillion-dollar industry, the live fish trade had found impudent defenders, behind-the-scene apologists and unscrupulous supporters. As the ocean is being raped and devastated in silence, the criminals are laughing merrily on their way to the bank,' he added.

But in spite of the environmental sellout in Palawan, the 'ban-the-live-fish-trade' approach snowballs. The political leaders of Tawi-Tawi, Samar and Polilio, a group of islands in Quezon, claiming their marine ecosystems are under siege, have announced their respective plans to declare the commerce in live fish illegal.

Agriculture Secretary Roberto Sebastian, whose department has jurisdiction over fisheries, however, has taken a pessimistic view of the long-term effect of the ban.

In a memorandum to President Ramos, Mr Sebastian said that 'a total ban is counterproductive as it penalises even legitimate live fish growers and exporters and discourages the adoption of new environment-friendly methods of fishing.'

In lieu of the ban, Mr Sebastian is pushing for the nationwide implementation of a Comprehensive Cyanide Fishing Reform Program.

The CFRP puts emphasis on efficient law enforcement through the operation of fool-proof cyanide detection testing laboratories and the implementation of alternative livelihood, net training and massive information and education programmes.

The DA hopes to regain the country's status as number one supplier of tropical fishes in the world market and sustain the economic gains from live food fish exportation without sacrificing the wealth, beauty and diversity of Philippine coral reefs. As an NGO thoughtfully advises in an anti-cyanide fishing poster: '*Corals need not die to catch fish alive.*'

Exploitation of seahorses and pipefishes

by M. Prein,
ICLARM,
Manila, Philippines

This article was originally published in Naga, the ICLARM quarterly newsletter, January 1995.

Any perception of seahorses and pipefishes as cute but rather irrelevant fishes is about to change. These fishes are now the targets of a large international trade, the scale of which is probably unsustainable. They are also victims of wholesale destruction of their inshore habitats.

Seahorses and pipefishes (syngnathids) are sold primarily for use as Chinese medicines and aphrodisiacs but also as aquarium fishes, curios and foods. The recent economic boom in China has created an explosive demand for animal and plant products used in traditional medicine. Public attention has been on tigers, rhinoceroses and bears but seahorses are also highly valued.

Syngnathids are credited with curing ailments ranging from asthma and arteriosclerosis to impotence and incontinence. They also provide remedies for skin ailments, high cholesterol levels, excess throat phlegm, goitres and lymph node disorders. They are reputed to facilitate parturition, to act as a powerful general tonic, and to provide a potent aphrodisiac.

All seahorses and pipefishes apparently serve the same purposes in Chinese medicine, but they differ in their perceived efficacy and thus in their value. Prices in Hong Kong in May 1993 ranged from about US\$250 per kg for 'inferior' small brown seahorses to about US\$850 per kg for large bleached seahorses. Traditionally, prescriptions are tailored to each patient's needs. The syngnathid is bought whole, sliced into chunks, ground to a powder and blended with other plant and animal products. Bleached seahorses are apparently becoming less popular because of worries about chemical residues and loss of nutrient value. A sign of the times in China is that prepacked medicines are flourishing.

We currently have evidence of seahorse and/or pipefish exports from Australia, Belize, Brazil, Ecuador, India, Indonesia, Kuwait, Malaysia, Mexico, New Zealand, Pakistan, the Philippines, Spain, Sri Lanka, Tanzania, Thailand, United Arab Emirates, United States of America and Vietnam. Many of these countries also use seahorses domestically.

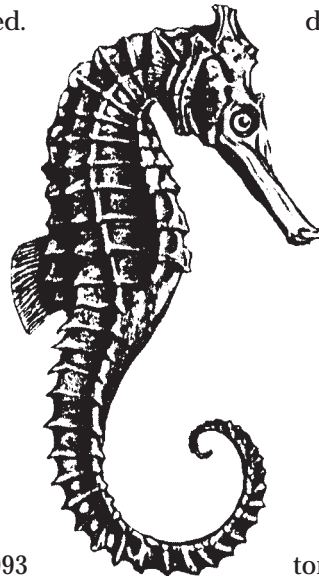
China, Taiwan, Hong Kong and Singapore are large importers that also re-export. The scale of Japanese and Korean involvement is uncertain.

The Philippines export both live and dead seahorses. Most are hand-collected as a target catch although some are caught incidentally in trawl nets. Fisheries may earn up to 80 per cent of their annual income from selling seahorses to local buyers, who then sell to wholesale exporters.

Live seahorses can suffer very bad treatment en route to hobby aquarists in Europe and North America. Large seahorses are worth more dried for the Chinese medicine trade than as live aquarium fisheries, so they are killed. The live seahorse is hung in the sun by a string around its snout and its tail flails for a holdfast until it desiccates. Dried syngnathids are often traded by merchants specialising in sea cucumbers (*bêche-de-mer*) since sources, handling requirements and markets are similar.

Globally, my best guess is that 20 million seahorses were traded last year. The total figure may be much higher, given the difficulty in obtaining data. A reliable source puts China's 1992 consumption at about 20 tonnes of dried seahorse (about 6 million seahorses), which would represent a ten-fold increase in ten years. Taiwan recorded imports of about 3 million animals last year but this figure ignores the high level of smuggling across the Taiwan Strait. Available evidence suggests that Singapore and Hong Kong used at least as many. The pipefish trade, while smaller, is also substantial.

All indicators are that this level of seahorse exploitation is unsustainable. Sparse distributions, highly structured populations, mate fidelity, low fecundity, lengthy parental care and low natural adult mortality make seahorses very vulnerable to intense harvesting. Indeed fishers report declining numbers and sizes of animals. Some areas are now yielding only juveniles, indicating that the population is at risk. Worryingly, we were repeatedly told that seahorse supply does not meet demand.



Biology

Management and conservation initiatives are going to be difficult because we know very little about syngnathid biology. There are something like 300 species in about 30 genera, of which seahorses comprise one genus of about 35 species, but the taxonomy is in chaos. They live in seagrass beds, mangroves and reefs in most shallow coastal waters of the temperate and tropical regions, but we do not know geographic distributions for most species. Adults are site-faithful—they are poor swimmers and rely on their tail to anchor to a holdform—but juveniles probably disperse and seahorses may migrate seasonally.

A few recent studies have focused on their extraordinary reproductive ecology. In syngnathids, only the male becomes pregnant. The evolution of the male brood pouch can be traced across genera, from simple ventral gluing in some pipefishes to the completely sealed seahorse pouch. Females transfer eggs to the male's brood pouch, where they are fertilised, and then provide no further parental care. Males protect, aerate, osmoregulate and nourish the developing embryos for up to six weeks (depending on species and water temperature), before releasing them as independent young.

In terms of their reproductive ecology, the syngnathids studied thus far fall into two broad categories.

1. Some pipefishes mate promiscuously. Each female confers eggs on more than one male and males of some species accept partial clutches from more than one female. Neither male nor females hold home ranges and both sexes move large distances. Females compete more intensely than males for mates—and are commonly larger, more colourful and more conspicuous than males.
2. Seahorses and other pipefishes are rigidly monogamous. One male and female mate repeatedly and exclusively with each other and these pair bonds are reinforced with daily greetings, occurring shortly after dawn throughout the male's pregnancy. In the seahorse *Hippocampus whitei*, for example, the female moves to the male's small home range at the core of her larger home range, passing other males en route, and the pair perform a greeting dance lasting six to 10 minutes. In these species, males compete more to obtain mates—and males are larger, more colourful and more conspicuous than females (where there is any difference).

Syngnathids are voracious carnivores, preying upon crustaceans, larval fishes and plankton. The few studies on their feeding ecology suggest that they may play a substantial role in structuring at least some benthic faunal communities.

Young seahorses, in their turn, are killed and eaten by fishes, crustaceans and anemones. Rates of predation on adult syngnathids are low, probably because they are highly cryptic and heavily armoured.

We need to know much more. During the next two and a half years, I will be working with local biologists to study seahorse populations in the Philippines and Vietnam.

We will document the basic biology of exploited species, assess the conservation threat posed by the seahorse trade, and explore options for managing and protecting seahorses and their habitats. Although habitat destruction may be more of a threat than any direct exploitation, seahorses could serve as a very attractive flagship species for efforts to protect seagrasses and mangroves.

We would be most grateful for any information at all (however seemingly trivial, descriptive or anecdotal) about the harvest of and trade in seahorses and pipefishes. It would be helpful to receive examples of dried syngnathids being sold, especially if they are labelled with purchase location, price and as much other information as possible. The following questions give some idea of our interests:

- What species of seahorse and pipefish are being caught or sold?
- How are they used? Dried as medicines? Live as aquarium fishes?
- What are the buying and selling prices for seahorses and pipefishes?
- What are seahorses and pipefishes worth as a portion of annual income of the fisher or dealer?
- Who buys the seahorses and pipefishes? Where?
- Has the price per seahorse or pipefish changed recently? By how much?
- Where are the seahorses and pipefish caught? Country? Habitat?
- When? Does the catch vary with the season or time of day?

- How? By hand or trawl or other method? As a target catch or a bycatch?
- How many are caught per unit of time?
- Has the supply of seahorses and pipefishes changed? Over what time period? Why?
- Is there any attempt to culture seahorses or pipefishes?
- Has there been destruction or degradation of local seagrass, mangrove or reef habitats occupied by seahorses or pipefishes? How, when and where?

The killing reefs

by L. Dayton

This article was originally published in The New Scientist, 11 November 1995, Vol. 148, No. 2003

A wave of death and ecological destruction is sweeping across coral reefs in South-East Asia as fishermen turn to cyanide to maximise their catch.

Diners in fashionable restaurants in Hong Kong, mainland China and Taiwan, can pick a brightly coloured reef fish as it swims in a large tank, and a short time later have it served to them steaming on a plate. Reef fish, freshly killed and cooked, have become so popular that restaurants cannot get enough of them. But satisfying that demand has left a trail of destruction across the reefs of the South China Sea and western Pacific.

A network of dealers in South-East Asia ships thousands of tonnes of live reef fish a year into the region's main cities, mostly through Hong Kong. The appetite for live fish is so great that the dealers encourage fishermen to catch as many as they can, as quickly as they can. In response, fishermen in many areas have laid aside their hooks and lines and turned instead to cyanide, with devastating results.

According to the first comprehensive report on the trade, published last month, it is not just fish that are dying but the reefs themselves, and no one is sure how long it will take them to recover, if they ever can. As it exists today, the trade in live reef fish is unsustainable, says Paul Holthus, a biologist with the Nature Conservancy, an American conservation group based in Hawaii. It is, he says, the marine equivalent of 'clear-cutting' a forest.

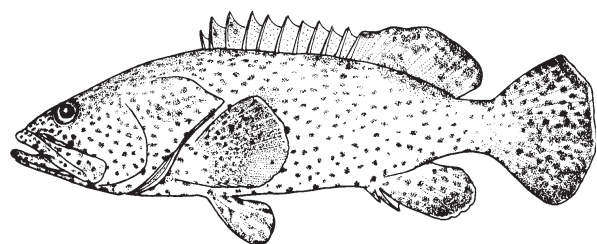
Reef fish are prized for their beauty and flavour, and for the prestige they give to a host, says the report, written by Robert Johannes, a reef ecologist formerly with the CSIRO, Australia's national research organisation, and Michael Riepen, a fisheries economist based in Wellington, New Zealand. A large humphead wrasse or highfin grouper can cost US\$180 a kilogram in Hong Kong, while a plate of humphead wrasse lips, an exceptional delicacy, commands prices of around US\$225 per plate.

The two researchers—who were funded by the Nature Conservancy, the US-based Pew Foundation and the fisheries agency of the South Pacific Forum, which represents 16 nations in the region—have traced the trade back to the 1960s, when rich entrepreneurs in Hong Kong 'developed a taste for coral reef fish'. As the culinary fad grew, coral reefs near Hong Kong and mainland China were rapidly fished out. In about 1969, traders began to move their operations to the rich waters off Indonesia and, in 1975, to the Philippines.

Many of the fishermen who catch reef fish are living below the poverty line. They are enticed into catching live fish by the high prices offered by traders who care nothing for local fishing regulations. Often, traders either underreport or do not bother to report catches, say the two researchers.

Fishermen tend to be 'remarkably forthright' about their activities, says Johannes. 'But the higher up you go the more circumspect people become, not only because there is a great deal of illegal activity—poaching, bribery as well as the use of illegal (fishing) methods—but also many companies are involved and each doesn't want the other to know what it is doing'.

Gauging the size of the trade proved to be a difficult task. Johannes and Riepen found that most trading nations keep only sketchy import and export figures, collect little data on domestic trade in live fish and have incomplete records of companies operating within their borders.



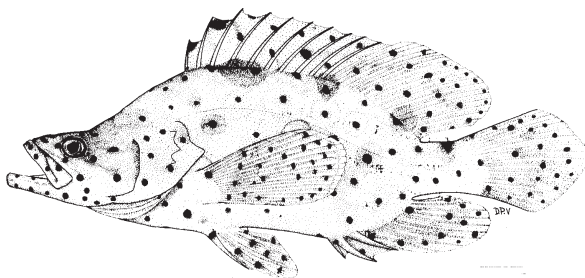
In Hong Kong, for example, government officials who collate import statistics do not even define live fish as fish. 'There doesn't seem to be a category for them at all', says Johannes.

The researchers based their report on whatever official statistics they could glean, together with figures from national non-governmental organisations and international conservation groups such as the World Wide Fund for Nature. Johannes and Riepen also visited nine countries in the region and interviewed hundreds of fishermen, villagers, university researchers, divers and representatives of the industry.

They estimate that dealers shift between 20,000 and 25,000 tonnes of live fish a year, worth more than US\$1 billion. Last year, companies in Manila alone flew US\$40 million dollars worth of live reef fish to companies in Hong Kong. No statistics exist for fish shipped by sea. 'That figure does not really reflect the magnitude of the trade because you have a very high mortality of these fish—sometimes 100 percent mortality before they reach (port)', says Johannes.

But he stresses that the size of the catch is 'not nearly as important' as the destruction of so many other species on the reefs. The move away from hook-and-line fishing to quick and very dirty techniques is not just depleting the reefs of fish, it is killing all other forms of life. In some places, fishermen use dynamite to catch fish. 'They told me they are switching to cyanide because it doesn't draw attention to what they are doing', Johannes says. Dynamite also kills fish, which is no good for fishermen who want to cash in on the more lucrative live trade.

Today, divers armed with bottles of sodium cyanide solution choose their prey and chase it into a hole in the reef. They then squirt the fish with the poison to stun it and haul it to a holding pen on the surface. If the fish recovers, the fishermen take it to port where dealers transport it on to markets such as that at Aberdeen on Hong Kong Island. Wholesale prices range between US\$40 and US\$180 a kilogram, depending upon the species.



The amount of cyanide that accumulates in fish caught with poison is well below safety levels set by the World Health Organisation, so diners are unlikely to be affected by it. Big fish can also survive the poison, but not the invertebrates and small fish that live on the reefs. 'The small fish swim in crazy loops, then sink, quivering, to the bottom', Johannes says. 'They are dead'.

Bob Richmond of the University of Guam Marine Laboratory has found that cyanide also kills corals at concentrations 'hundreds of thousands of times lower' than the typical concentrations used by divers. Without the tiny corals, the reef ceases to grow at all. Divers told Johannes and Riepen that entire reefs have been destroyed in this way.

'In extreme cases the reef becomes almost deserted', they write. 'Some larger corals, as big as small houses, can be as much as 400 years old. It will be at least the 25th century before living coral of this size will be seen again in such areas'. It is far from clear how widely the destruction has now spread. To conduct surveys of reefs in the region would cost tens of millions of dollars and take years to complete, says Johannes.

Live fish importers admit that target species are disappearing fast from reefs off the Philippines, and that Indonesia's reefs will be in a similarly depleted state within five years. As the harvest from these reefs diminishes, the operators are looking elsewhere, to Papua New Guinea, the Solomon Islands and the Pacific islands of Tuvalu, Kiribati and Tonga. Eastwards, the Maldives in the Indian Ocean are already home to a growing live fish industry, says Johannes.

So far, attempts to control the trade have met with mixed success. Australia—which has a small live fish industry based on hook and line fishing—has the economic clout to keep most fishermen on the ecological straight and narrow. In the Philippines, although President Fidel Ramos has ordered the navy to stamp out abuses, there are not enough resources to do the job, says Corazon Del Mundo, a research biologist with the Bureau of Fisheries and Aquatic Resources in Quezon City. 'We are undermanned', she says, and the maritime police and local officials sometimes take bribes from operators.

In the Pacific, the laws that govern fishing vary from country to country and are 'changing all the time', says Andrew Richards, a marine biologist with the Pacific Forum Fisheries Agency at Honiara in the Solomon Islands. But he suspects that most forum nations see the trade in live fish as 'an

attractive proposition', offering fishermen an opportunity to make more money than they do selling the same fish, killed and chilled.

In Hong Kong, at the heart of the trade, government officials have done nothing at all, says Yvonne Sadovy, a marine biologist at the University of Hong Kong. 'They do not even manage their own marine fisheries', she says. 'They are not likely to manage somebody else's. Keith Wilson, a biologist with the Hong Kong Agriculture and Fisheries Department, confirms these fears. 'We haven't been informed by the Indonesian authorities that there is a problem in their domestic waters (or by) the Philippines', he says. The result is that there is no official concern and no action.

Reef rights

Riepen and Johannes conclude that it will be impossible to shut down the trade completely. But then nobody wants to close it down because so many people rely on it for their livelihoods. 'It's a fishery that's worth exploiting and can be exploited sustainably', says Riepen. But sustainable fishing can only come about if countries act in concert. A good start, say Johannes and Riepen, would be for

nations to pass laws upholding traditional ownership. They point to Palau and the Solomon Islands, where local people hold legal rights to reefs and their fish. People on these islands have fought to protect their reefs as a resource for themselves and their children.

In addition the researchers recommend that governments sit down with scientists and non-governmental organisations to discuss ways to monitor and control the live fish trade. And this process has now begun. A recent statement by President Suharto of Indonesia signalled that officials there had finally realised the dangers posed by overfishing. And recently in Jakarta, the Indonesian government hosted an international conference, bringing together all the interested groups, to discuss putting the trade on a sustainable basis.

Riepen is optimistic that the reefs will be saved, simply because it is in everyone's best interests. He warns, however, that action must be taken soon if the reefs are to be preserved as a sustainable source of food. 'To see it disappear in three-to-four years is just crazy', he says. 'Let's exploit it for years to come'.

The stressful journey of ornamental marine fish

*by Jaime Banquero,
Ocean Voice International,
Canada*

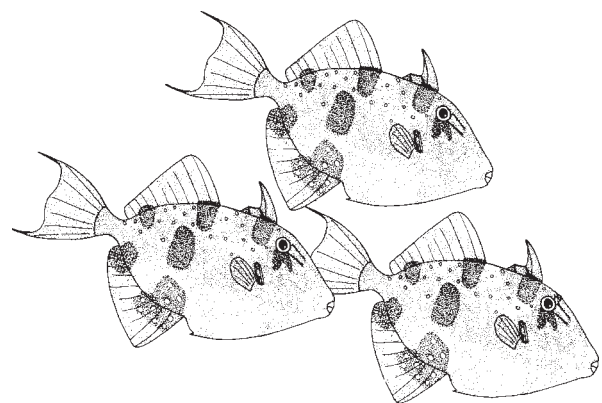
This article was originally published in Sea Wind 9(1)

Importers as well as retailers and aquarium hobbyists buying ornamental marine fish from the Philippines are recording high mortality rates. In a previous article (*Sea Wind*, July – September 1992), I underlined the fact that cyanide was not the only factor responsible for these high mortality rates. One of the most important factors is the physiological damage inflicted on the fish by fisherfolk and by the exporters.

(Mis)handling methods and holding facilities

The ordeal of net-caught fish starts when it is removed from the reef. But this is only the start of its miseries. Once ashore, there are no holding facilities and submerged cages are not widespread because of the lack of protected areas, the tide and theft. Thus the fish are dumped from the bags into a bucket with up to 30 fish at once. The fish are then transferred abruptly into bags filled with new water from the shoreline.

Depending on the species, they are bagged individually if they are expensive, or by pairs in smaller bags, or several in larger bags. The bagged fish remain on the floor or on wooden structures, usually for three to five days before they are shipped. During this time, water is changed once a day. Expensive species get two water changes a day. The



water changes are always abrupt. Small inexpensive fish do not get water changes for three to five days. I observed a large bag with, for example, more than 10 poisonous lionfish per bag, 15 fragile butterflyfish per bag and more than 70 damselfish in the same bag. It is common to see fish dying from ammonia poisoning in the bags.

The fish are shipped to the exporter in Manila by bus, where they are first inspected for damaged fins, injuries or sickness. The rejects are either sold on the local market or discarded, and very seldom returned to the sea. The fish which are accepted are dumped abruptly into the holding tanks without acclimatisation or quarantine. Apparently some exporters do not feed the fish for weeks. The filtration systems of most of the exporters' holding facilities are completely inefficient.

There are no devices such as protein skimmers to improve water quality and in the few rare cases where such devices are present, they are not built to handle high water volumes. The water flow through the tanks is limited to a trickle. I visited only one holding facility where conditions were better than the rest and I sensed there was a willingness to improve conditions even more.

When an order is placed, the fish are transferred into bags containing water which in most cases is taken directly from Manila Bay and surrounding waters. One exporter claims that their shipping water comes from 150 km outside Manila. This water stagnates in large cement pools and is not filtered. Samples of shipping water indicated high ammonia levels in all facilities that I visited.

Stressed to death

The fish are not acclimatised to the physical and chemical conditions of the water upon each transfer, thus going through a series of stress episodes from the moment they are harvested. Samples from both the bags containing fish and the holding facilities showed alarming results. In closed conditions, the ammonia which fish excrete is a crucial factor. If the pH is low, the ammonia is ionised and is not toxic.

However, if the pH is suddenly increased by an abrupt water change, serious osmoregulatory problems start occurring.

In bags, fish are exposed to acute concentrations of ammonia, low pH and oxygen depletion. When transferred abruptly into holding tanks they undergo drastic temperature, salinity and pH changes.

By being kept in bags for prolonged periods and in holding tanks without adequate filtration, fish are subject to conditions such as: acute exposure to ammonia, low pH and oxygen depletion. In the holding tanks they are possibly exposed also to copper and other heavy metals present in the epoxy used in the construction of the tanks. When fish are transferred they experience further stresses such as drastic temperature and salinity changes and sudden pH fluctuations. Fish under stress are also less resistant to disease. After so much stress, it is not surprising that most fish do not make it.

Improvements needed soon

Earlier this year, I gave a series of workshops about water quality and filtration systems to members of the Haribon Foundation and the Federation of Aquarium Fish Collectors of the Philippines. This Federation, established in 1993, is trying to strengthen local organisations working for the protection of the environment and to raise the socio-economic status of its members. The concept of water quality was new to all. The Federation's success in achieving its goals will depend on assuring a supply of net-caught fish, teaching the water quality criteria to the collectors and the exporters in the Philippines, establishing real handling techniques and redesigning holding facilities.

Ocean Voice International and the Haribon Foundation for the Conservation of Natural Resources have developed education and training programmes (the Netsman Project) to encourage the use of small nets instead of cyanide for the capture of ornamental fish for the marine aquarium hobby, and to empower local communities to manage their coral reefs.

Workshops on water quality criteria as well as handling techniques will be added to the already established net training programme. A water quality explanatory manual for fisherfolk will be written. Holding facilities at the fisherfolk level should be designed in a simple and efficient way, and consist of cement pools with circulated water pumped from the shoreline.

By better capturing, handling and holding ornamental fish, the Federation of Aquarium Fish Collectors will gain credibility and the support of buyers. Since the survival of ornamental fish will increase from the time they are collected to the time they are exported, the environment will also benefit because fewer fish will have to be harvested. Everybody will gain from such improvements, not only people but also the fish.

Propagation of reef corals for the international aquarium trade [Phase I: Cnidaria: Alcyonacea]*by Gerald Heslinga*

Summary of the final project report, written by Gerald Heslinga, under the Saltonstall-Kennedy Industry Grant Program, National Marine Fisheries Service, National Oceanic and Atmospheric Administration

The international aquarium trade is a US\$4 billion industry which has historically relied on wild capture of tropical fish, invertebrates and plants to stock the tanks of millions of hobbyists worldwide. A rapidly growing sector of the marine aquarium trade involves the display of coral reef organisms in ornamental exhibits called reef tanks.

Because coral reefs are regarded as globally threatened habitats, the collection of corals and other reef organisms to stock reef tanks is a source of concern among policymakers in the nations where coral reefs occur naturally.

This concern has led to increasingly strict controls on the capture and export of wild reef life. Because the viability and growth of the international marine aquarium industry depends to a great extent on the continued availability of corals and other reef life to stock ornamental displays, environmentally sound alternatives to wild capture are urgently needed.

This report describes a NOAA/NMFS project undertaken at Palau's Micronesian Mariculture Demonstration Center in 1994 to address this need. We present progress on the development of new methods to mass-propagate soft corals (Cnidaria: Alcyonacea) in captivity using an environmentally sound, non-extractive approach.

We describe the demonstration of these techniques to a local aquarium exporting firm, the presentation of research findings at a national conference of aquarists and an aquarium industry trade show in the United States, and our joint efforts with a US mainland-based company to promote and market the cultured soft corals to consumers at wholesale and retail levels.

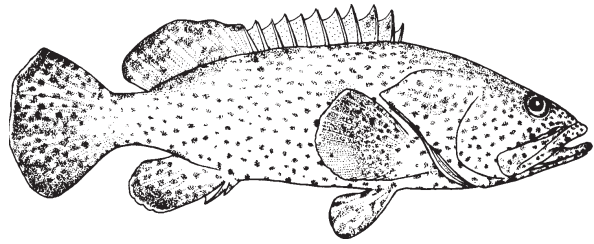
We conclude that soft coral farming can be commercially viable under favorable conditions, especially if carried out as part of a broader effort to supply a diverse menu of cultured reef organisms to the aquarium trade.

Corals are among the most reproductively prolific marine organisms on earth. Paradoxically they are regarded as threatened species, because the marine habitats in which corals live have been subject to many abuses by humans.

This project provides a useful example of how certain photosynthetic reef organisms, particularly the asexually reproducing colonial invertebrates, can be rapidly domesticated and mass-produced for commercial purposes with no negative impact on the marine environment. This approach can yield both economic and environmental benefits.



LIVE REEF FISH MISC. NEWS



Big wally rescued from dinner

*Source: The South China Morning Post
(19/11/95)*

A 30-year-old reef fish has escaped the dinner tables of Hong Kong. Big Wally the Maori wrasse was to be exported live to the territory, or cut up for fillets in North Queensland. But Andrew Plimmer, managing director of live fish exporters Austfish didn't have the heart to send Big Wally on a one-way trip to Hong Kong.

He and caring staff at Austfish, Cairns, won permission from the Great Barrier Reef Marine Park Authority to release Big Wally among his wrasse relatives at Norman Reef.

Big Wally, a 40 kg humphead Maori wrasse caught by handline off the coast at Bowen, North Queensland, would have been sold for A\$2,500 (HK\$14,305).

But now, after almost four weeks in captivity, he will be transported to Norman Reef in a fast, advanced dive vessel *Seaquest* and released. The Great Barrier Reef location has become known for its tame wrasses.

Rita Pring, of Austfish, says Big Wally is older than most of the staff. 'He's so old and so beautiful and has so much expression on his face. It brings tears to my eyes thinking of him being able to swim away again. He eats from my hand and likes to be patted', she said. Wrasse can live for up to 80 years, and can grow to over two metres long.

Austfish staff have also adopted a barramundi, nicknamed Big George, who like Big Wally has escaped the dinner plate.

Cyanide fishing accusation unfounded

*Source: The South China Morning Post (25/11/95)
[Richard Yip, Assistant Director of Fisheries]*

I refer to the article headlined HK role in death of reefs 'ignored' (*South China Morning Post*, 13/11/95). This article is based largely on a report recently issued by the US Nature Conservancy and South Pacific Forum Fisheries Agency entitled 'Environmental, Economic, Social Implications of Live Reef-Fish Trade in Asia and the Western Pacific' and prepared by Drs R. Johannes and M. Riepen.

Your article accuses the Hong Kong Government of ignoring the devastation of coral reefs in the region through cyanide fishing.

This accusation is unfounded. Hong Kong has long established fisheries protection legislation prohibiting the possession and use of toxic substances, including cyanide, to capture fish. There is presumption in this legislation that, should a toxic substance be found on board a vessel, it shall be deemed to be possessed or used for the purpose of fishing and any fish found in the vessel deemed to have been caught by using the toxic substance.

Reef fish are associated with coral reefs in tropical coastal waters. The control of inshore fisheries is a matter for the authorities of the country concerned.

In this regard, we wrote to the Indonesian authorities in January this year, seeking clarification of the legal requirements for export fish from Indonesia and requesting further information regarding destructive reef fishing. However, we have not received a reply.

The study report made 19 recommendations, most of which are not applicable to Hong Kong. One recommendation which could apply to Hong Kong, and was mentioned in the article, is the establishment of a cyanide detection laboratory to test live fish imported into Hong Kong. A testing programme is being evaluated but this may not solve the problem because, even with appropriate detection facilities, fish could be held for a sufficient period before being imported so that body cyanide falls below detectable levels.

According to the Department of Health's food surveillance programme, all foods for sale, including locally-produced or imported fish, are subject to inspection and sampling for bacteriological, chemical and biotoxin examination. Detection of cyanide in fish is also covered by the programme. Of the fish samples taken for cyanide analysis between January 1994 and September 1995, none detected to contain cyanide.

Your article states that 18,000 tonnes of reef fish are imported into Hong Kong by traders and implies that they are all caught by traders and that they are all caught by squirting cyanide to stun them. It is misleading to infer that all reef fish are caught by such illegal cyanide methods. The majority of reef fish species, for example, coral trout, are easily caught by hook-and-line fishing methods. Only a small percentage of the trade involves fish such as the Napoleon humphead wrasse (*so mei*), which are difficult to catch by conventional non-destructive methods, and therefore susceptible to cyanide use.

There have been occasional incidents of Asian fishermen found fishing illegally in the waters of countries in the Indo-Pacific region. However, we believe that Hong Kong fishermen are very rarely involved in illegal fishing for reef fish. The live reef fish industry in Hong Kong is sustained by legitimate trade between overseas local reef fishing communities and Hong Kong traders. Most fish are imported into Hong Kong by specially-adapted carrier vessels and not by Hong Kong-based fishing vessels. The rest are air-freighted to Hong Kong.

If the study's findings that many species of reef fish are under immediate threat are accepted, then the best approach is to effect controls on trade through the Convention on International Trade in Endangered Species (CITES). We have already recommended to the authors of the study and to the US Nature Conservancy that the most pragmatic and effective way to control international reef fish trade and protect any species considered endangered would be to list them under CITES.

Comments highly misleading

*Source: The South China Morning Post (1/12/95)
[Robert Johannes]*

Richard Yip, Assistant Director of the Agricultural and Fisheries Department, has taken exception in these columns (25 November) to your article concerning the report co-authored on cyanide fishing and the live reef food fish industry.

Some of his comments are highly misleading. He states, 'We believe that Hong Kong fishermen are very rarely involved in illegal fishing for reef fish'.

In fact, as we point out in our report, Hong Kong fishing companies are massively involved, especially in Indonesia, but also in other countries, including the Philippines and Papua New Guinea. Recent laws force them to employ nationals of the countries in which they operate. But until these laws were passed these companies brought most of their fishermen with them.

Hong Kong live reef fish companies continue to provide fishermen they hire with cyanide, which is inflicting colossal long-term environmental damage on the world's biologically richest marine communities. They also bring about the deaths of many unsuspecting fishermen by equipping them with diving gear without teaching them how to avoid the bends.

We estimate that several hundred cyanide fishermen die from the bends each year in Indonesia and

the Philippines. Hong Kong fishing companies are not the only ones responsible, but they play a major role.

Another misleading statement of Mr Yip's is that 'coral trout are easily caught by hook and line', and so are therefore not 'susceptible to cyanide use'. In fact, they are easier to catch with cyanide than with hook and line. So, to minimise costs, cyanide is widely used for their capture. Thus, Mr Yip's assertion that 'The live reef fish industry in Hong Kong is sustained by legitimate trade between overseas local reef fishing communities and Hong Kong traders' is, at best, wishful thinking.

If Mr Yip doubts these assertions we would be happy to show him documentary evidence consisting of the eye-witness accounts of ex-employees of some of these companies, government and university biologists, professional divers, and angry villagers whose reefs have been pillaged.

Should he doubt their collective testimony, we have access, in addition, to plenty of video and photographic documentation.

I do not wish to imply that all Hong Kong live reef fish companies are guilty of these practices. But the many who are give the entire industry an appalling reputation.

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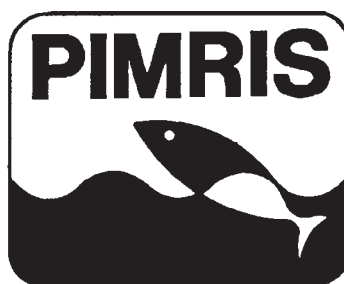
Worth noting*by Robert Johannes*

MARINELIFE is a newsletter published quarterly by the International Marinelife Alliance (IMA) for the benefit of its members, friends and supporters. The live reef-fish trade (food and aquarium fish) is a major focus. The current issue also features an article by Dr Carl Safina on the devastating effects of the shark fin fishery. Subscription is free. News and feature stories, letters, cartoons, poems, essays and other literary contributions are welcome. Contact International Marinelife Alliance, Philippines, P.O. Box 12648, Ortigas Center Post Office, Pasig,

Metro Manila, Philippines. Fax: (632) 631 9251 (e-mail: IMA@Phil.gn.apc.org).

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PIMRIS is a joint project of 4 international organisations concerned with fisheries and marine resource development in the Pacific Islands region. The project is executed by the South Pacific Commission (SPC), the South Pacific Forum Fisheries Agency (FFA), the University of the South Pacific's Pacific Information Centre (USP-PIC), and the South Pacific Applied Geoscience Commission (SOPAC). Funding is provided by Canada and the Government of France. This bulletin is produced by SPC as part of its commitment to PIMRIS. The aim of PIMRIS is to improve



Pacific Islands Marine Resources
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the availability of information on marine resources to users in the region, so as to support their rational development and management. PIMRIS activities include: the active collection, cataloguing and archiving of technical documents, especially ephemera ('grey literature'); evaluation, repackaging and dissemination of information; provision of literature searches, question-and-answer services and bibliographic support; and assistance with the development of in-country reference collections and databases on marine resources.